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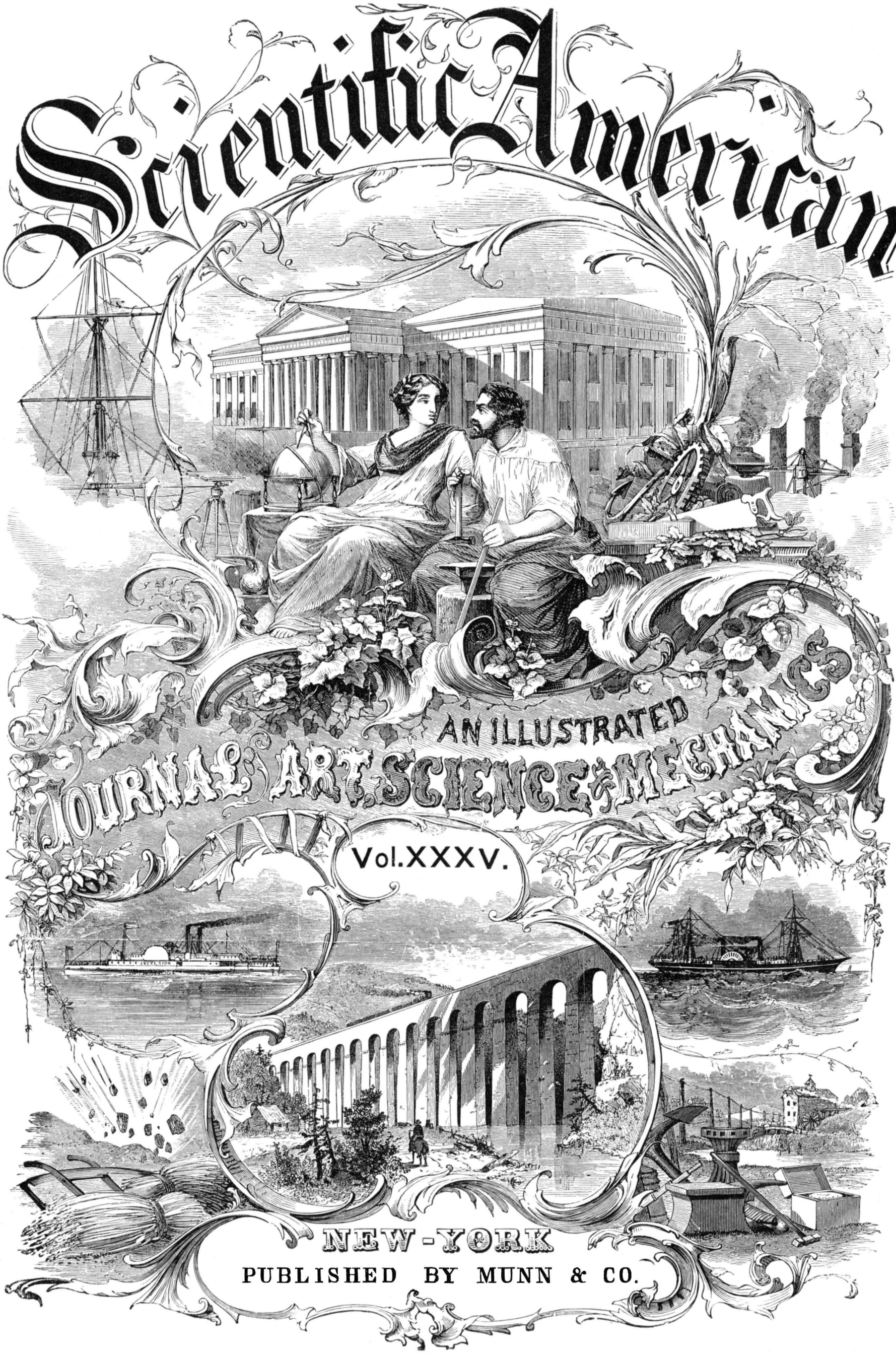

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Vol. XXXV.

NEW-YORK

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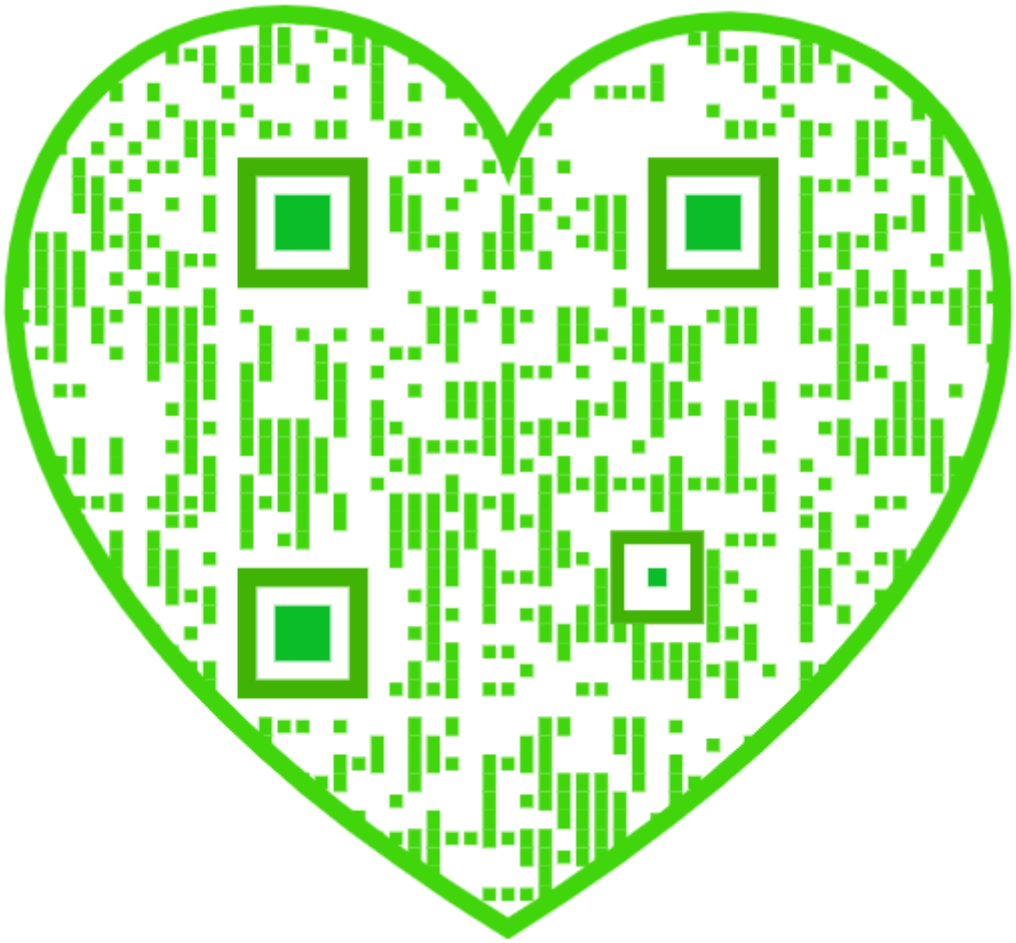

SCIENTIFIC AMERICAN

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Vol. XXXV.—No 1. [NEW SERIES.] NEW YORK, JULY 1, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

A SINGULAR COLLISION.

The engraving on this page, selected from the pages of the *Railroad Gazette*, was made from a photograph taken on the spot, and is therefore a correct representation of the scene. It has been stated that the managers of the road on which the accident occurred paid a large sum of money for the negative, with a view to prevent the circulation of copies and publication of the picture; but one copy at least escaped their vigilance, and the result is before our readers. Our contemporary, like ourselves, is unaware of the locality of the accident, all particulars having been carefully kept from the public; but the C 3443 on the stock car may be a clue as to the rolling stock composing one of the trains, although the interchange of railway cars is so frequent as to make it difficult to determine on which line such an accident actually occurred. The trains were certainly not passenger trains, as both engines are freight locomotives; and if happily no one was killed or injured, the railroad authorities might be able to conceal from the public the singular catastrophe.

Of the violence of the collision, there can be no doubt; and it doubtless occurred on a straight piece of line, or one or both of the engines would have been thrown from the track laterally. The interlocking of the driving wheels, the rupture of the side bars, the complete and clean division of one cylinder longitudinally (leaving one half attached to the cylinder head in which the piston rod is at rest), together with the upheaval of probably 60 tuns dead weight, show the tremendous force with which the leviathans must have met, and the speed at which they must have been running, to cause such utter destruction when they were suddenly brought to rest. Perhaps some of our readers will give further details of the occurrence, and tell us on what road it happened.

THE GALLAHUE ROTARY ENGINE.

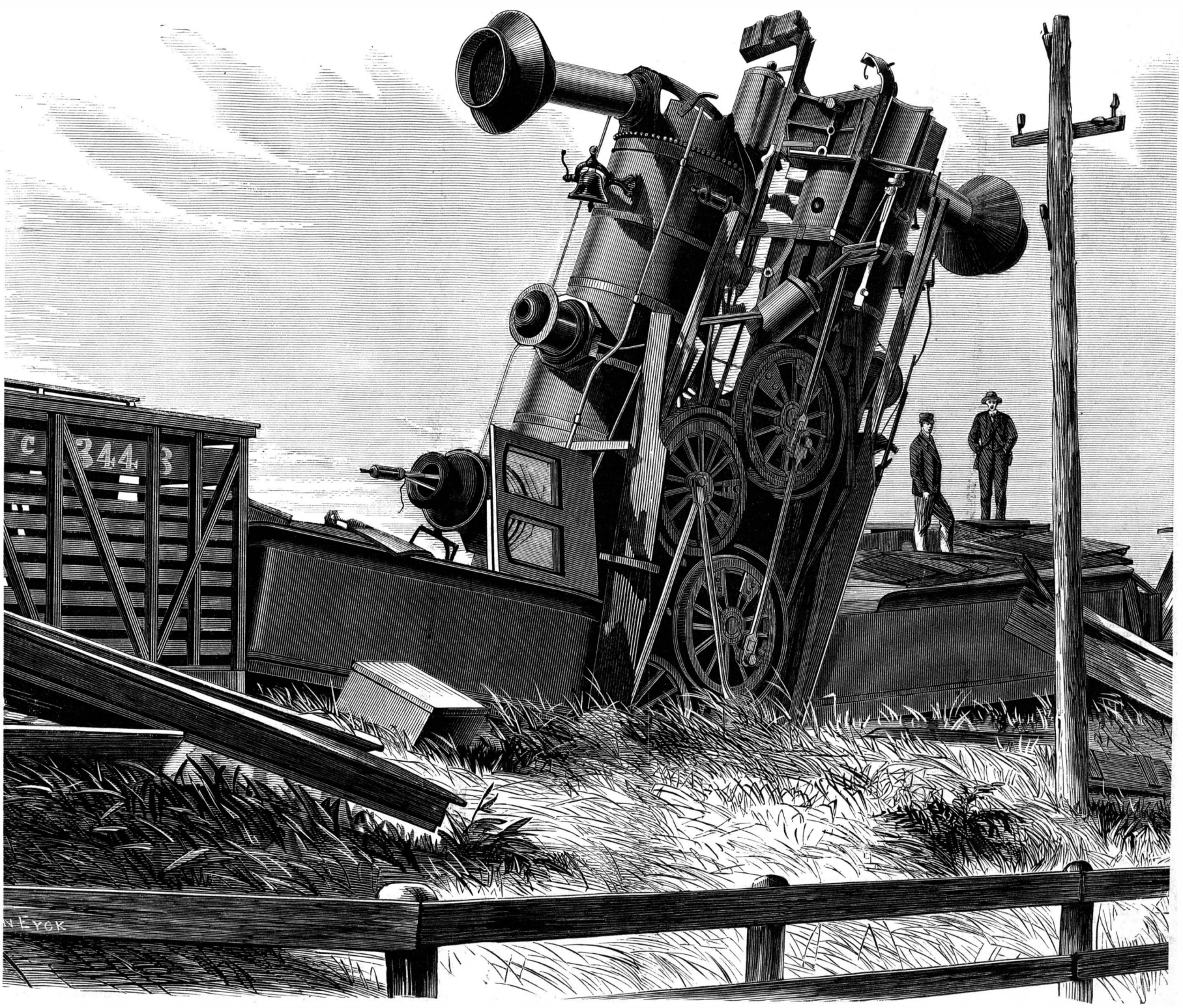
We have recently had occasion to examine the operation of a new rotary engine devised by Mr. A. C. Gallahue, applied to the propulsion of a launch some thirty feet in length. The construction of the machine, briefly described, includes two hollow cylinders whose surfaces run in contact with each other, and the shafts of which are connected by exterior gear wheels. In the peripheries of these cylinders are pistons (two in each cylinder) which are set out against the side of the shell by interior bolts and nuts. To these last the steam has no access. In each cylinder, at the extremities of the diameter, perpendicular to that joining the pistons, are made transverse grooves, so that in passing the point of tangency the piston of cylinder No. 1 enters the groove in cylinder No. 2, and *vice versâ*. It will be observed that there are no sliding abutments, and that the points where wear may be expected are at the edges of the pistons and at the ends of the cylinder. In the first instance, said edges are hardened, and the wear is taken up by leaf springs, inside the cylinders, provided with set screws. At one end the cylinders abut directly against the head. Between their other ends and the opposite head are placed two disks, between which is fibrous packing. Set screws, passing through the head, act on the outer disk, so that, by setting these up as becomes necessary, a tight fit ensues.

Making 180 revolutions at 80 lbs. of steam, the inventor rates the engine we saw—which occupies a floor space of but 18 inches square, and has a piston area of 15 square inches—at 12 horse power. We can state that the machinery worked smoothly and without jar or pound, and that, whether standing still or working, there was no evidence of steam being wasted by blowing through. The exhaust was clearly and sharply apparent, and the manipulation of the engine, whether reversing, going ahead, or holding, was effected with facility.

The inventor informs us that in smooth water a speed of over twelve miles an hour has been maintained. Under proper conditions, we think that the engine would be found well suited for boat propulsion, as well as wherever light power is required. For further particulars the reader may address Messrs. A. C. Gallahue & Co., Morrisania Station, New York city. For prices, see advertisement on another column of this issue.

Selenium Experiments.

R. J. Moss has discovered that, when a bar of selenium is placed in the exhaust tube of a Sprengel pump and the air exhausted, the selenium becomes electrically conductive in the course of ninety hours. The selenium is then found to be covered with a delicate film of mercury, from the globule contained in the pump; and the conductivity is ascribed to this film.



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Contents.

(Illustrated articles are marked with an asterisk.)

Alloy for models (37)	12	Lily culture	7
Answers to correspondents	11	Locust pest, the	9
Aquarium in New York city	6	Locusts, the	5
Belgian centennial exhibit, the	3	Mercury, expansion of (1)	11
Birdseye view, a (23)	11	Moon and the ecliptic, the (26)	11
Bleaching oils (9)	11	Moon, apparent size of the (20)	11
Bleaching stearin (15)	11	Mustard, fermenting (10)	11
Boiler furnace for slack, etc. (5)	11	Naphtha, benzine, and gasoline	7
Boiler furnace, hot blast*	4	New books and publications	9
Boilers for small engines (39)	12	Patent decisions, recent	9
Boilers, pressure in (27)	11	Patents, American and foreign	10
Bronze on copper and brass	8	Patents, official list of	12
Business and personal	11	Permanganate of potassa (8)	11
Car bridge, railroad*	6	Poles of the earth (25)	11
Casks, filling pores of (14)	11	Potato bug, the	3
Centennial exposition, the	3	Power, force, and speed (29)	12
Centennial, scenes at the*	4, 5	Pressure in oil wells (33)	12
Civil engineer's convention	9	Pressure in tin vessels (80)	12
Coffee as a deodorizer	7	Railway accident, remarkable*	1
Collision, a singular*	1	Red calcium light (7)	11
Cultivator, a novel*	4	Ropes, fireproof (18)	11
Diamonds, cleaning (11)	11	Sawing steel bars, etc. (6)	11
Drill chuck, improved*	6	Scientific relics, historical	6
Dyeing with artificial alizarin	6	Scorpions of Egypt, the*	7
Earth's heat, the	2	Selenium experiments	1
Emery wheels, speed of (37)	12	Sewing on buttons, device for*	6
Engines, dead centers of (16)	11	Silk, cleaning	7
Engines, horse power of (17)	11	Soda water (13)	11
Farmer's foes, the	3	Spontaneous combustion	9
Fence stakes on a hill (8)	11	Steam in a pipe (28)	11
Files, cleaning (27)	11	Steam jackets on cylinders (31)	12
Fishes, nest-building*	7	Stove makers, Canadian	3
Furnace radiation (34)	12	Sulphate of potassa, new	6
Gas burner, self-regulating*	4	Surface plates, making*	8
Ginger ale, Belfast	4	Telegraph sounder wire (22)	11
Grease from hats, removing	7	Testimonial, a misapplied	3
Gunpowder as a motor (1)	11	Ventilation, window	4
Ice ponds, look to your	4	Water, power of (35)	12
Iron, fiber in puddled	6	Wire, iron and steel	3
Iron vessels, strength of (12)	11	Wood, bending (36)	12
Japan at the centennial	3	Wooden water pipes (32)	12
Kerosene and galvanized iron	11	Working men's homes	2
Lightning rods (24)	11		

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 1.

For the Week ending July 1, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876. With 9 illustrations.—Interior of the Women's Pavilion, 1 engraving.—Cold Rolled Shafting.—Gould Fire Engine, 4 cuts.—Langen and Otto Gas Engine, 4 engravings.—Architecture of Main Building.—First Engine in America.—Phosphor Bronze.—English Iron and Steel Exhibits.—Steam Engine Exhibits—Shapley, Hoadley, Williamson, Griffiths and Wedge, N. Y. Safety Steam Power Co., Fleming & Son, Fleck, Goldie & McCulloch, Brush.—The U. S. Department.—Brazilian Silkworms and Coins.—The Krupp Gun and other Krupp Exhibits.—Woodworking Machinery.—Armor Plates.—Paper-Making Machinery.—Wire Rope.—Saw Sharpener.—Improved Loom.

II. ENGINEERING AND MECHANICS, 9 engravings.—Crank Shaft of U. S. S. Trenton, 2 figures.—American Steel Tires.—New Alpine Tunnel.—Bursting of a Fly Wheel.—Convention of American Society of Civil Engineers.—Centennial History of Engineering.—Railroads of the World.—Express Engines, Midland Railway. 2 large engravings.—The Steam Locomotive.—Water Supply for Towns and Villages, by C. DELAFIELD, C. E.—Raising the Vanguard.—New Ice Machine.—The Collis Browne Screw Propeller, 3 figures.—Water Supply, Sycamore, Ill., 1 figure.—New Tide Power, 1 figure.

III. ELECTRICITY, LIGHT, HEAT, ETC.—Electric Transmission without Wires.—Discovery of Gallium, 10 figures.—New Rays of Calcium.—Studies of Matter and Life, by PROFESSOR H. J. SLACK: Modes of Motion, Ether of Space, Wave Forces, Limits of Vision, Size, Motion, and Force of Atoms, Phenomena of Reproduction, Mental Phenomena.—Nature of Thermo-Electricity.—Facsimile Telegraphy.—Electric Light.

IV. CHEMISTRY AND METALLURGY.—Osmium.—Native Platinum.—Idohyric Acid.—Crystallization of Meteoric Waters, 2 figures.

V. AGRICULTURAL AND MISCELLANEOUS, 3 engravings.—The Chinese in America—Turner's Prizes.—Fly Wheel Dangers.—The Kentucky Shower of Flesh.—Disposing of Raw Manure.—Dublin Spring Cattle Show: Prize Shorthorns, 3 engravings.—Large Poultry Yard.—The Opossum.—Mexican Alabaster.

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NEW INVESTIGATIONS ON THE EARTH'S HEAT.

The theory ordinarily accepted as accounting for the creation and present condition of the earth is based on nebular hypothesis, and assumes that the globe, at one time gaseous, subsequently became molten, and is in that state now, with the exception of a comparatively thin crust, estimated to be about to be about 60 miles in thickness. Our knowledge of the interior condition of the earth, however, is mainly speculative; and the strongest support to the above theory is met with in the increase of temperature noted on descending into mines and like excavations. This increase is estimated to be about 100° per mile; so that, supposing it to continue through a distance of but 100 miles, or $\frac{1}{35}$ part of the earth's radius, a temperature of no less than 10,000° Fah. must exist at that depth below us. Such a temperature would liquefy all solid substances with which we are acquainted, and vaporize many solid elements. On the other hand, it may questioned whether the effect of the immense pressure on the earth's interior, due to the action of the imprisoned vapors and to the superincumbent weight, must not suffice to remove the limits of the solid crust far below the above estimate; so that liquefaction may begin only at a distance of several hundred miles from the surface, and there may be still sufficient viscosity in a large part of the remaining interior portion to prevent free movement of the liquid nucleus.

We have said that our knowledge is but speculative, and its principal confirmation is found in the fact that, wherever excavations have been made, the increase of temperature noted is met with. From this, however, it follows that, if the interior of the globe is in a state of fusion, the relative distances necessary to descend in order to produce like augmentations of heat must be comparatively less as the center of the earth is approached. The heat coming from the interior, transmits itself by conduction while traversing spheres more and more vast; and supposing the conductibility of the mass to be uniform, the temperature of the exterior, layers of the globe should diminish in proportion as their volume augments.

Recent investigations by Professor Mohr, of Bonne, at the deepest well in the world, have adduced results altogether at variance with the preconceived estimates referred to above, and which, if hereafter substantiated in other localities, will tend to throw grave doubts on the igneous theory of the earth. The well in question is located at Speremberg, near Berlin, Prussia, and has been sunk to a depth of 4,000 feet. The thermometric record is as follows:

Depth	Thermometer (Réaumur)	Increase per 100 feet
700 feet	15·654°	
900 "	17·849°	1·097°
1,100 "	19·943°	1·047°
1,300 "	21·939°	0·997°
1,500 "	23·830°	0·946°
1,700 "	25·823°	0·896°
1,900 "	27·315°	0·846°
2,100 "	28·906°	0·795°
3,390 "	36·756°	0·608°

The third column decreases in arithmetical proportion, showing for each descent of 100 feet equal differences of 0·050° or $\frac{1}{20}$ ° Réaumur, equal to 0·11° Fah. Applying this ratio to the depths below 700 feet, and between 2,100 and 3,390 feet, Professor Mohr forms a table as follows:

Depth	Increase per 100 feet	Depth	Increase per 100 feet
100 to 200 feet	1·35°	1,500 to 1,700	0·896°
200 " 300 "	1·30°	1.700 " 1,900	0·846°
300 " 400 "	1·25°	1,900 " 2,100	0·795°
400 " 500 "	1·20°	2,100 " 2,300	0·745°
500 " 600 "	1·15°	2,300 " 2,500	0·695°
600 " 700 "	1·10°	2,500 " 2,700	0·645°
700 " 900 "	1·097°	2,700 " 2,900	0·595°
900 " 1,100 "	1·047°	2,900 " 3,100	0·545°
1,100 " 1,300 "	0·997°	3,100 " 3.300	0·495°
1,300 " 1,500 "	0.946°	3,300 " 3,390	0·445°

Continuing this, the author finally determines that, at a depth of 5,170 feet, there will be no further increase of temperature, and that the heat indicated at that distance will be true to the center of the earth. Obviously also this temperature will not very greatly exceed that marked by the thermometer at 3,390 feet, or 35·756° Réaumur, equaling 114·701° Fah.; so that, according to these observations, the highest internal heat of the globe falls below that of boiling water.

WORKING MEN'S HOMES.—SIR SYDNEY WATERLOW'S LONDON ENTERPRISE.

The problem of providing healthy and comfortable homes for the working classes is one with which students of social science have largely dealt in Europe, and one which, ere very long, must in this country demand earnest and thoughtful consideration. It is an undeniable fact that, so long as working men are compelled to live in the vicinity of squalor or filth, or are crowded into tenements where every sanitary precaution is neglected, their condition, both moral and physical, must suffer; and the legitimate result is the injury and depreciation of the class in whose well-being the prosperity of the community in great measure depends. For economical reasons, if none other, society cannot afford this undermining of its foundation; and hence it follows that, philanthropy aside, it is to the interest of all to keep the subject agitated until some amelioration of the present state of affairs is accomplished.

Relief from the overcrowded tenement is, perhaps, nowhere more needed than in New York. Rapid transit, when gained, will do much towards improving matters by opening cheap homes in the suburbs; but even then an immense number of people will still be obliged to live in the heart of the city. For them, and for their brethren in other populous localities, as well as for working men in factory towns, improved homes are urgently needed; and until the same are provided, the epidemics which yearly afflict the denizens of tenements, and are due most frequently to foul and impure air, may be expected. Nor can we hope to materially decrease the number of the intemperate so long as the attractions of the bar room are set off against cheerless and comfortless homes.

There are two ways of accomplishing the required end, namely, either the workmen may coöperate or capitalists can promote the matter as an investment. Both plans have been successfully tried in England. It is certain that to wait for philanthropy to do the work is not wise. On one hand, philanthropists like George Peabody, or Peter Cooper, or Baroness Coutts are few and far between; and on the other, a majority of working men possess a feeling of independence to which the notion of accepting any benefit savoring of charity is especially repellent. Experience has shown that the working man will prefer poor and even unhealthy quarters to the best accommodations, so long as the latter savor of the almshouse in disguise. While such schemes are necessarily based on philanthropy, that fact is best kept in the background, and the project should be put on a dollars and cents basis, which precludes the idea of obligation.

Now as to the two practical ways: The practice of coöperation has been a favorite one among English working men for many years, and it has worked marvelous results. It is based on the sound policy of cash payments. and dividing the profits of trade among members. Land and building societies are two of its forms. A working man desiring a house joins a society, who effect the lease for him. Instead of paying his landlord, he pays a certain subscription and interest to the society; and when his subscriptions are paid up, the association buys the house and conveys it to him. Those who do not purchase houses receive a dividend and bonus on their shares. The Permanent Building Society, of Leeds, England, has furnished healthy tenements for about two hundred families. There are also towns and villages in Lancashire where very large sums have been saved. In Burnley, the Building Society, of 6,600 investors, in one year saved $800,000. This society has assisted in hundreds of cases by advancing money on mortgages, which are repaid by easy instalments. It will be seen that these societies aid men to keep themselves by saving money to buy their own homes; and when it is considered that no such wages, even proportionately to cost of living, are paid in England as American workmen receive, the results show wonderfully the advantage of the habits of thrift thus promoted.

Passing to the second plan, this is also divisible. It may be carried out by individual employers for the benefit of their employees, or by corporations for the benefit of the whole working class in general. The former would be the course in manufacturing villages and towns, the latter in great cities like New York. We can best exemplify the working of both by example. In South Lancashire, the cotton spinning mills of the Messrs. Ashworth have been in operation for some seventy years. Owning a large tract in the vicinity, the proprietors have built complete villages The cottages are of stone, two stories, and very comfortably arranged. The rentals are at fair prices. The men are paid regularly, and they in turn as regularly pay their rent. Schools are provided. In a word, so well organized and controlled is the great establishment that crime and misery are practically unknown. Drinking shops are abolished, there has never been a case of theft in the place, and great numbers of the men have become owners of their own houses. At Saltaire, where the vast wool-spinning works of Sir Titus Salt are located, 756 houses are rented by the work people. Each house is separate in all its appointments, has every sanitary convenience, and the rent is within the operative's means. There are no drinking houses; but in their place are public laundries, baths of all kinds, libraries, schools, reading rooms, and, in fact, Saltaire is as near Utopia as the most enthusiastic social reformer might hope.

So much for single-handed work. Great as are its results, they are exceeded by those achieved by the Industrial Dwellings Company in London. Here is a corporation based on a philanthropic foundation, but conducted on business principles, which render its working a model for future emulation. Some fourteen years ago Sir Sydney H. Waterlow (who, by the way, is now in this country, serving as chairman of the English jury on the Paper and Stationery Department of the Centennial, and to whom we are indebted for the following facts) erected at his own expense a block of dwellings in the heart of London, provided them with every convenience, and rented them to about 80 families at sums sufficient to yield a fair return on the outlay. So satisfactory were the results that a company was formed, with a capital of $250,000, to erect more buildings on a similar plan. The capital has from time to time been increased, and at present the total resources are about $5,000,000. The income is 11 per cent on the cost of the property; and for the past five years, there has been a large surplus profit after paying 5 per cent dividends. There are now 1,596 tenements in occupation, accommodating 6,750 people; others are in progress, and the present capital will provide 2,799 tenements, to accommodate 12,115 people.

The buildings are of brick, ornamented with copings of artificial stone, made on the spot by the company, from Portland cement and coke breeze. This is easily and cheaply molded into tasteful forms, and is remarkably durable. The tenements, which are entirely separate, contain from two to four or five rooms; and every one, whether large or small, contains a compact little kitchen fitted with a range, boiler, clothes chest, and sink, and is provided with an abundance of water. The closets are detached from the tenements, and are separately ventilated. There is also a neat contrivance

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for dust, which is thrown down a shaft to a receptacle in the cellar, whence it is removed. The hight of the rooms averages 8 feet 6 inches, and the superficial area about 130 feet. The rent averages 50 cents per week per room. A suite of five rooms costs $5.75. In other words,for about the same or a little less money than it costs in this city to hire a floor in a rookery, or in a building in which, in nine cases out of ten, sanitary laws are ignored, the working man may obtain a pleasant, comfortable home : better, it appears, in many respects than the French flats which rent here at from $500 to $750 per year, for a suite of rooms.

The effect of the above project has been a marked improvement in the moral, physical, and social condition of the working people who have availed themselves of the advantages offered, and a greatly diminished sick and death rate, as compared with London generally. It also has served to show how a work of genuine philanthropy and charity may be accomplished without impairing the self-respect of the beneficiaries, and may at the same time, afford a fair interest to the invester.

THE FARMER'S FOES.

The terrible pests which have wrought such ruin on the agriculture of whole districts of this country have appeared; and they have commenced their detestable industry with undiminished vigor. A correspondent in Iowa says: "Potato bugs are more numerous this year than they were last;" one in New Jersey reports: "Our State is particularly infested with potato bugs;" and similar accounts from Pennsylvania, Virginia, New York, and Massachusetts have been published in the columns of our contemporaries.

Professor Riley, State entomologist of Missouri, in his valuable report for 1875, states that, although the beetles were very numerous last spring, they became comparatively scarce and harmless, and did not become multiplied till the third brood had developed, by which time the crop was sufficiently matured to be out of danger. He reports that a beetle (*lebia atriventris*, black-bellied lebia), half an inch long, has been seen to destroy the potato beetles in Maryland, and the common crow has been observed to devour them, and even to dig them out of the ground whither they had retired to hibernate.

Among artificial remedies and preventives, Paris green seems to maintain its lead, and some new facts as to its use have recently been published. The poison can be cheaply manufactured as follows, but much danger will be avoided and trouble saved by buying it already prepared of dealers. Dissolve 2 lbs. sulphate of copper in 1 gallon hot water, in a stone jar. In another jar put 1 lb. white arsenic and 2 lbs. pearlash in 44 lbs. hot water, and stir till dissolved. Mix when needed in the proportion of 1 part of the former to 5 of the latter. Use with a sprinkler. Professor Riley states that the potatoes themselves show no trace of injury from arsenical poisoning ; and he quotes Professor Kedzie to the effect that the soil is uninjured by the use of Paris green. Even water from the soil will not become poisonous unless the Paris green is used in excess of the requirements of insecticidal purposes.

The locusts are now commencing business, and giving, by their numbers and activity, some indication of the prospects of the season. Our readers are familiar with the doleful history of this plague, and of the devastation of large sections of Kansas, Missouri, Iowa, Nebraska, and other States by it. Professor Riley's observation of the nature and habits of the locust is laborious and careful ; but the remedies yet discovered seem to be much out of proportion to the extent of the disaster. Destroying the eggs by shallow plowing, burning the unfledged young, cutting off the march of the adult insects by digging ditches, catching them in nets and seines, and burning sulphur seem to be useless against foes which occupy the land, not by counties merely, but by whole States, and which are as the snowflakes for multitude, and multiply with great rapidity. "Every bushel of locust eggs destroyed is equivalent to 100 acres of corn saved," says Professor Riley. The encouragement of game birds and sparrows is recommended, and the distinguished scientist believes that this will be found to be one of the best means of checking the increase of the species ; but he justly adds that national means of averting the evil must be used, if anything can be done at all. To this end, our legislators may well address themselves ; and the diffusion of sound practical knowledge on this subject is a work which Congress might take up in perfect assurance that it could not be more usefully employed.

A MISAPPLIED TESTIMONIAL.

One of those erratic geniuses with which every editor is more or less familiar, through his persistent seeking to ventilate absurd theories in our public journals, recently advertised a lecture in this city, on "Magic Reciprocals, a Mathematical Revolution." The announcement in the daily newspapers stated that the discourse was to be given at the request of a number of our best known citizens, headed by Mr. Peter Cooper and Mr. William Cullen Bryant; and at the door of the hall, a printed copy of the very flattering invitation, with signatures appended, was handed to every comer. While it is, of course, possible to doubt the authenticity of the document, the fact nevertheless remains that the statement that the lecture was asked for by these gentlemen was paraded in the papers repeatedly without eliciting contradiction from them. The result was that a goodly audience, including several scientific men, gathered to hear about the supposed discovery. Instead, they listened to a jumble of utterly absurd mathematical assumptions and misstatements, mixed with metaphysics and a notion of the Darwinian theory apparently imbibed from some misinformed religious newspaper. The gist of the theory was the assertion that a point is the reciprocal of a straight line: supported by not a shadow of logical reasoning, but by a series of elaborate drawings in colored inks of right lines, forming figures somewhat analogous to the multifarious curves produced by the geometrical chuck used in engraving bank note plates.

While no one can dispute the right of anybody to believe and to promulgate any mathematical nonsense that may please him, many, we think, will, like ourselves, regret the support, tacit or open, perhaps unwittingly, afforded by the signers of the invitation. If these gentlemen did append their names, they have simply asked public confidence in a theory which a moment's examination must have shown them was ridiculous ; if they did not, then a word of contradiction from any of them would have exhibited matters in their true. light. Some of these gentlemen, who have done valuable service toward the spread of scientific knowledge, will, we think, agree with us in the view that their countenance of such proceedings, whatever their private opinion may be regarding the inventor, is to be deplored, since it tends to bring the cause of Science into disrepute through conveying to people the idea that false and unfounded theories have been regarded by the learned as of genuine scientific importance. At the same time, the effect also is to place the charlatan or visionary enthusiast on a level, in the minds of many, with those emiment scholars who have aided so greatly to disseminate useful information through the medium of the popular scientific lecture. It would be better if the indiscriminate giving of laudatory testimonials could be confined where the practice belongs, among the venders of quack nostrums. Nothing is more certain than that, as regards mechanical inventions, reports of actual results through use alone are valuable; while true scientific discovery speaks for itself, and is superior to any one's opinion.

THE CENTENNIAL EXPOSITION.

A material change in the programme of the agricultural display has been made through the decision of the authorities that there shall be no competitive field trials of farm implements. As these trials have been announced in the prospectuses of the Exposition for the past two years, and as many exhibitors have made special preparations to undergo the tests, it certainly seems rather late in the day to abandon them now. The reason given is that such experiments, while they may demonstrate the excellent working of the apparatus, afford no idea of relative durability, a very important consideration to the user. It should be understood, however, that only the competition is ruled out. An exhibition of threshers and separators in operation at Schenck's Station, fourteen miles from Philadelphia, is now in progress, and on June 26 grass was to be cut, and on July 5 the wheat will be ready for reaping.

The attendance at the Exposition has been large latterly, and sufficient, if maintained, to secure its financial success. An unfortunate dissension arose a short time ago (but no longer exists,as we are informed), between the Centennial Commission and the Board of Finance, involving a conflict of the authorities, mainly regarding financial matters. Both boards have done good service, and it is greatly to be hoped that the organization and management may not devote to useless disputes the energy which has thus far contributed so greatly to the success of the enterprise.

THE BELGIAN EXHIBIT

in Machinery Hall is well calculated to excite general surprise at its extent when the small size of the country is considered, but is not, on the whole, to be wondered at when we recal the rapid progress in every industrial pursuit made by the Belgian people. A pair of Corliss engines built by P. Van Den Kerchere, of Ghent, are remarkable for admirable design and workmanship, and are considered by many engineers to be in some respects superior to the great Corliss machine itself. The largest apparatus exhibited is one for boring and tubing mine shafts and wells below the water level. Special interest attaches to the various railway exhibits, as the railroads of the country are among its largest sources of revenue. The different specimens of rails exhibited are of an improved pattern, and some are so arranged as to do away with the wooden sleepers common in this country. There are also new varieties of the street car rails, and new designs for holding such tracks in place. Next comes a large number of different sized railway buffers and springs, made of forged iron and used on railway cars to deaden the force of concussion. There are also numerous specimens of car couplings and wheels. Among the general machinery are two spinning machines with specimens of products, and a lift and force pump having a continuous piston motion, raising water to any hight. There are, besides, specimens of connecting rods for engines, the process of bellied turning, an interesting model of a system of machinery for the utilization of greasy waste, from railroads, from suds of wool scouring, residue of palm oil, etc.

JAPAN.

We have already alluded in some detail to the fine Japanese display in the Main Building. The agricultural exhibit bears the same marks of completeness and admirable selection. All the various process of silk culture, from the hatching of the eggs to the production of the silk, are fully explained by models, charts, etc., from the government office for experimental silkworm breeding at Tokio. Here are shown the large hampers made of bamboo and used in carrying the mulberry leaves from the field to the place of rearing; also the boxes used for keeping the leaves fresh for two or three days for the young worms. Then come the bamboo baskets for separating the parts of leaves of different weight, and the knives used in cutting them from the branches, together with the chopsticks for handling the worms, as the perspiration from the fingers is considered injurious to them. A very fine series of mulberry leaves and modes shows the process of cultivation in different soils; also specimens of insects injurious to the trees are also exhibited. In fine, the visitor has only to use his eyes to learn an immense amount of interesting information regarding the great silk industry of the Japanese empire.

Tea culture is illustrated by diagrams, showing modes of cultivation of the plant and specimens of the teas, together with examples of the method of packing. The manner in which the Japanese woods are displayed is especially good. Each particular variety, of the hundred or more exhibited, is shown both dressed and in a rough state, and beside it are placed portions of the bark and a few leaves from the tree. Each specimen is distinctly labeled with its name, an improvement which would greatly facilitate inspection if it could be carried out through all departments of the Exposition.

If any one is curious to know something of Japanese food, he will find displays of cured fish and hams, pickled fruits, sauces, and bottles of mineral waters. Some of the sauces which take the place of the omnipresent Worcestershire or catsup are produced from a variety of curious ingredients. Soy is made of fermented wheat and beans mixed with table salt; another, called nagaoka, is made of clean pounded barley, wheat, and soja hispida (a kind of bean), malted, with salt. These substances are brewed together, kept for about three years, and are then ready for use.

Bamboo is so extensively used in Japan that the large extent of the exhibit might well have been expected. From hugh poles, thick enough to form supports to a house and 20 feet in length, down to the most delicate wicker work and nets, the useful reed is presented in every conceivable form. A separate section is devoted to the display of shells, skins of fishes, horns, and feathers of various kinds; another is filled with barks and dye stuffs, another with a beautifully arranged collection of cereals. In fact, the Japanese display is surpassingly good ; and if the visitor undertakes to study the resources of any one country as evidenced in the Centennial, he can devote himself to the examination of none with more pleasure and profit than to those of Japan.

IRON AND STEEL WIRE.

The visitor need not expect to find all the metal exhibits in Machinery Hall, although presumably this department is the proper place for them. Some of the finest are in the Main Building. The Washburn and Moen Wire Works, of Worcester, have erected a huge column 12 feet high, built of coils of clean new wire, each coil being of immense length. One shown to us weighs 525 lbs., and is over a mile long,and is made from American pig iron without weld or joint. The same concern exhibit ramrod wire in great bunches, a column of glistening broom wire, scores of coils of pin wire, steel furniture wire, belt hook wire, telegraph wire, clothes line wire, and whole heaps of wire for general purposes. Certainly few can realize to how many different ends wire is applied. Here, for example, is the fine steel material used in pianos, another variety for making wire gauze window screens, and a new invention for tying hay bales in lieu of the wooden withes now employed.

A magnificent specimen of forging is exhibited by Phillips, Nimick & Co., of Pittsburgh. Interspersed with saws and saw steel of all shapes, tastefully arranged upon the walls, are immense bars of iron, bent cold into knots as if by the hand of some giant. There are a great wrought iron expansion joint for water pipe, rolled in two half circles and welded so as to resist a tremendous pressure, Sligo Special, or SS, plates that have withstood pressures of 77,000 lbs. per square inch, and the Sligo fire box, 106 inches in diameter, having 64,000 lbs. tensile strength. Near by, in the display of Hussey, Wells & Co., of Pittsburgh, is a homogeneous crucible steel boiler plate of 76,000 lbs. tensile strength. Beside it is an axle which has had five blows alternately, first on one side and then on the other, by a drop hammer weighing 1,600 lbs., falling 25 feet. The metal is bent slightly, but not broken.

Stove Making in Canada.

The American Stove Manufacturers' Union held a meeting in Philadelphia on June 15 last, and the first business attended to was the appointment of a committee on patent laws. The subject of patent protection has recently been brought before the notice of the Union by the alleged piracy of American designs by Canadian makers. General Rathbone informed the meeting that he saw in the Main Building of the Centennial Exposition, in the Canadian department, a stove of his own pattern, another of a pattern belonging to the firm which the President, Mr. Jewett, represented, and many other standard American works. He said that stoves were sent to Canada, and casts made of the patterns, which the Canadian manufacturers obtained letters patent for and sold as their own designs; and not only that, but they had the effrontery to send the same pattern to the Centennial Exhibition to obtain premiums for originality of design. He hoped the matter would be brought to the attention of the Centennial authorities, and such measures taken as would prevent the Canadians from receiving rewards for designs and articles which did not now and never did belong to them. President Jewett held that it was a swindle upon the public. Mr. Spear had suffered in the same manner. It was agreed that the committee on patent laws draw the attention of Congress to the necessity for a treaty with Canada of a reciprocal character.

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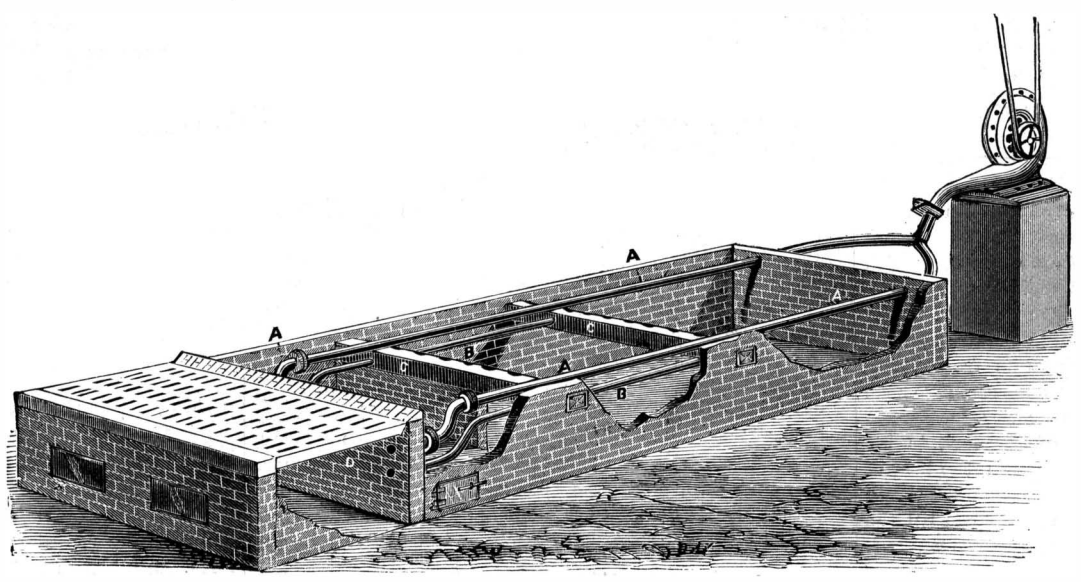
IMPROVED HOT BLAST BOILER FURNACE.

We illustrate herewith a new construction of boiler furnace, the object of which is to save the loss of heat due to waste through grate bars, through imperfect combustion of oxygen with the gases evolved, and through the frequent admission of cold air into the fire chamber. The manufacturers claim that double the number of cubic feet of air is required by natural draft to produce combustion that is necessary when a forced blast is used, because the needful amount of oxygen can be more perfectly combined with the gases at a point in the furnace where combustion is possible. Thus the heat ordinarily expended in elevating the temperature of the surplus air admitted is saved. This is done as follows: All the air admitted to the fire is conveyed from the fan, shown in the rear, through pipes, A A, along the fire bed to the airtight fire chamber, D, and under the grate. It thence passes up through the improved grate bars to the fuel, and is also forced back through the small pipes, B B, to the cross perforated pipes, C C, distributing the heated oxygen at proper points under the boiler, to unite with and assist in burning the escaping gases. The air is obviously heated before it enters the fire, the heat of the cinders, clinkers, and refuse of the furnace being utilized for this purpose, by pushing the hitherto unused material over the bridge wall and into the pit back of bridge wall, where it assists in heating the pipes, A, and, when cool, can be withdrawn at the door shown. It will be observed that there are no ash pit doors to be opened, and that there is no necessity of throwing open furnace doors to check combustion, that end being easily effected by stopping the air blast. Thus the furnace is protected from the injurious effects of sudden changes of temperature. On the improved grate, we are informed, all dust, shavings, tan bark, and other refuse will burn as well as the best lump coal. Besides thus producing economy, through the air arriving at the point of combustion already heated to the proper temperature by heat otherwise wasted, the general construction is such as to insure a cool and pleasant fire room, a condition hardly possible so long as fires are cleaned and hauled through the furnace doors. This furnace can be easily applied to boilers already set.

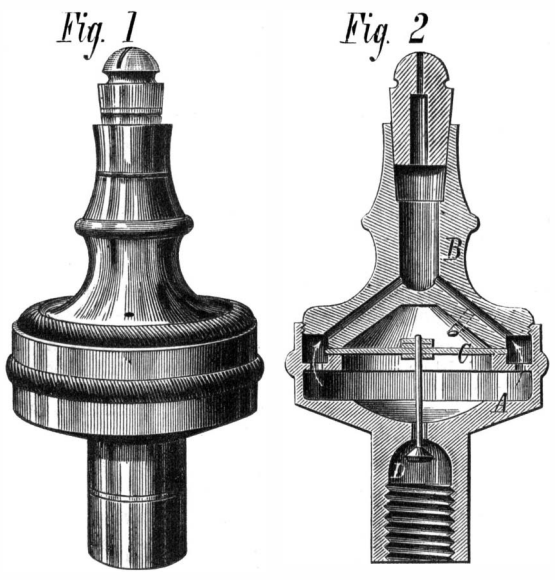


STRIBLING'S HOT BLAST BOILER FURNACE.

A large number of commendatory testimonials are submitted, showing that from twenty to thirty per cent of fuel is directly saved by the invention. For further particulars relative to sale of patent, address the manufacturers, Messrs. U. B. Stribling & Co., Madison, Ind.

MCMILLAN'S SELF-REGULATING GAS BURNER.

It has been demonstrated by experiment, by M. Lemoine, that, in order to obtain the greatest amount of gas light at least cost, the following rules should be remembered: 1. A good burner will produce four times the amount of light that a poor one will, the quantity of gas burnt being equal. 2. The intensity of the light increases with, but in a greater ratio than, the size of the slit. 3. The increase of illuminating power varies with the decrease of pressure. 4. The gas should be burnt at the lowest possible pressure. 5. The pressure should remain constant; and 6, the pipes should be large enough for the amount of gas carried through them.



In the new gas burner, illustrated herewith, it is claimed that the conditions stated in rules 4 and 5 above given are fully realized, and uniformity of flow and economy in the consumption of gas are combined with a simple, cheap, and durable construction. The engravings represent the device in full size, both exteriorly, Fig. 1, and in section, Fig. 2. The base section, A, forms a cylindrical chamber into which the lower concave part of the tip section, B, is hermetically secured. C is a flexible diaphragm of leather or other suitable material, which is interposed and fastened between the sections; this supports centrally the stem of a valve, D, which opens and closes from below the entrance aperture of the gas, according to the pressure of the latter on the diaphragm. The diameter of the chamber, in A, is larger than that of the diaphragm, so that, concentric with the diaphragm, there is an annular channel into which the gas flows through suitable apertures, as indicated by the arrows. The gas then passes by the inclined channels in the upper section to the delivery tube, and is there fed to the tip at any position of the upper section, without necessitating any special adjustment of the same to the gas-conveying channels, as the communication is established as soon as the sections are united. The flow is thus evenly maintained and is independent of the pressure below the valve. The regulating attachment may be kept within small compass, so as to be of ornamental appearance, and may be used to support the usual glass globe. The pressure at the tip of these burners when in use is stated to be about two tenths of an inch water pressure. It gives full flame with only five tenths pressure on the supply pipe, and will do no more with a pressure of thirty inches. Testimonials are submitted, showing in one instance a saving of twenty-six per cent of gas burnt in a period of eight months.

Patented through the Scientific American Patent Agency by D. D. McMillan, January 26, 1875. For further particulars address E. H. McMillan, La Crosse, Wis.

SCENES AT THE CENTENNIAL.

The extent and variety of the Centennial show afford many interesting and characteristic scenes to the observant visitor. In the upper part of the engraving on our following page is shown one of the entrances with the crowd congregated thereat. The entrance to the Grand Plaza, from Belmont and Elm avenues, is next shown, and a view of one of the stations on the narrow gage railroad that runs all round the grounds, affording much economy of time and labor, is also given.

The lower part of the picture is occupied by a view of a number of the principal buildings erected by the different States for the accommodation of their commissioners and delegations, which we have described so recently that any lengthy details of the structures which are represented in the engraving will not be necessary. The view represented was made from a point near the English government building, looking in an easterly direction along what is known as State avenue, on which most of these buildings are situated. The New York building, shown on the left hand of our picture, is a showy and convenient structure, with ample piazza room. The Governor's room, office, and the ladies' apartments are handsomely furnished and hung with paintings. Massachusetts has erected the building next in the line; it is somewhat oldfashioned in style, but thoroughly commodious in design and arrangement. The Connecticut building stands next; and though small, it is large enough for the purposes for which it is intended. New Hampshire has a plain square structure fifty by fifty-five feet, situated east of Connecticut cottage; beyond it are the headquarters of Wisconsin and Illinois. Indiana comes next, with a building of striking appearance. A little further to the eastward we come to one of the most substantial structures of the State group, that of Ohio. It is built of dressed stone from the quarries of that State.

The engraving is selected from the pages of *Harpers' Weekly.*

Window Ventilation.

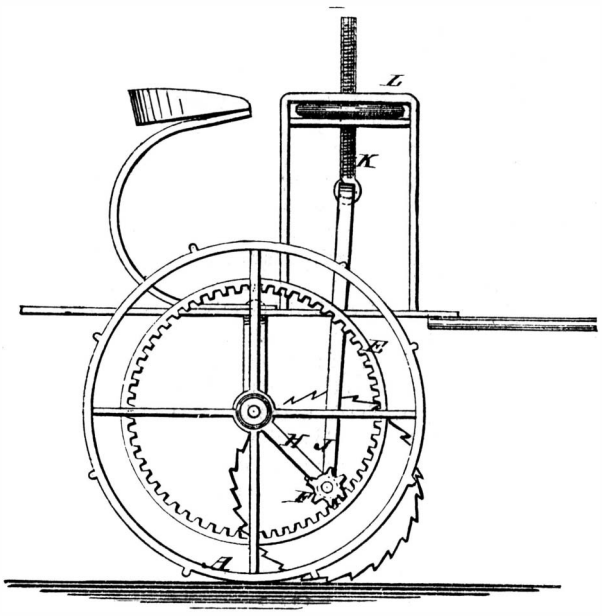
A writer in the London *Sanitary Record* gives the following instructions for making a cheap window ventilator: Take two pieces of board a quarter of an inch thick, one inch wide, and as long as the lower bar of the window; three narrow pieces half an inch thick and one and a half inches long, one end being cut with the bevel of the window stool. Nail these pieces across one of the long slats, one at each end and one in the middle, placing the short side of each piece even with the lower edge of the slat. Nail the other slat on the opposite side of these short pieces, bringing the upper edge of the slat even with the square end of the short pieces. This will make a compound bar with half an inch between the slats, and one slat half an inch higher than the other when the whole is turned upon its edge. Place the whole under the lower window sash, with the higher slat on the outside. The air can then pass under the outer slat, between the two slats, and enter the room over the top of the inside slat, having an upward motion which will cause it to mingle rapidly with the warm air of the room and thus prevent any sensible draft. By thus raising the lower sash, a space will be left between the top of the lower sash and the bottom of the upper sash, through which another thin layer of air may enter the room at some distance from the layer at the bottom of the window. The air must also enter with an upward current, causing it to speedily mix with the hot air in the upper portion of the room. This arrangement is especially adapted to secure safe window ventilation in bedrooms.

Look to your Ice Ponds.

There is a prevalent notion that ice purifies itself by the process of freezing. This is not based on trustworthy scientific observation, and, indeed, is not true. In the recent annual report of the State Board of Health of Massachusetts are given the details of an outbreak of intestinal disorder, clearly attributable to the contamination of impure ice. The malady broke out last summer in one of the principal hotels at Rye Beach, N. H., and, while not attended with fatal effects, extended to a large number of people. After long and unavailing search, the cause of the trouble was found in the pond whence the ice used in the hotel had, the winter before, been taken. The outlet whereby the body of water emptied itself had become obstructed, so that the water was rendered nearly stagnant. At the lower end where the feeding brook entered, and over a space 500 feet long by 150 wide, had accumulated a homogeneous mass of putrescent matter, composed of marsh mud and decomposing sawdust. This foul matter, held in suspension in the water, was conveyed by currents and winds to every part of the pond, and an analysis of the melted ice showed it to be heavily charged with such impurities. It is obvious, from this, that the same care given to wells and other sources of drinking water should be given to the bodies of water from which the usual ice supply is gathered.

A NOVEL CULTIVATOR.

Mr. James C. Stone, of Leavenworth, Kansas, has patented, through the Scientific American Patent Agency, May 2, 1876, a new cultivator, which pulverizes the soil and cuts up weeds by means of a series of circular saws. These are attached and driven in the simple manner represented in our engraving. On the drive wheel, A, are formed toothed gear wheels, E, which mesh the teeth of small gear wheels, F, attached to the saw shaft. The latter rotates in bearings on arms, H, which ride upon the journals of the axle at the inner ends of the hubs of the wheels, A, so as to keep the wheels, F, in gear with the wheels, E, however much the shaft may be raised. The saws are placed upon the shaft at a distance apart of three and a half inches, as may be desired, or as the character of the land to be operated upon may require. To the center of the bail, attached to the saw shaft, is pivoted the end of a screw, K, which passes up through a hand nut, L, swiveled to a bracket, attached to the frame, so that, by turning the said hand nut, the saws may be adjusted to enter the ground to any desired depth, or may be raised from the ground. The axle is suitably bent to accommodate the saws.



THE Belfast ginger ale, which has for the last few summers become quite a popular beverage, may be made as follows Powdered double refined sugar, 16 ozs.: bicarbonate of soda, 3½ ozs.: citric acid, 4½ ozs.: concentrated essence of ginger 1½ ozs.: essence of cayenne 4 drachms: essence of lemon, 40 drops. The soda, acid, and sugar must be carefully dried separately, at a temperature not exceeding 120°: and the sugar before drying must be thoroughly incorporated with the essences, to which a small quantity of caramel as coloring may be added. This forms a powder, a dessertspoonful of which will make a tumblerful of the drink.

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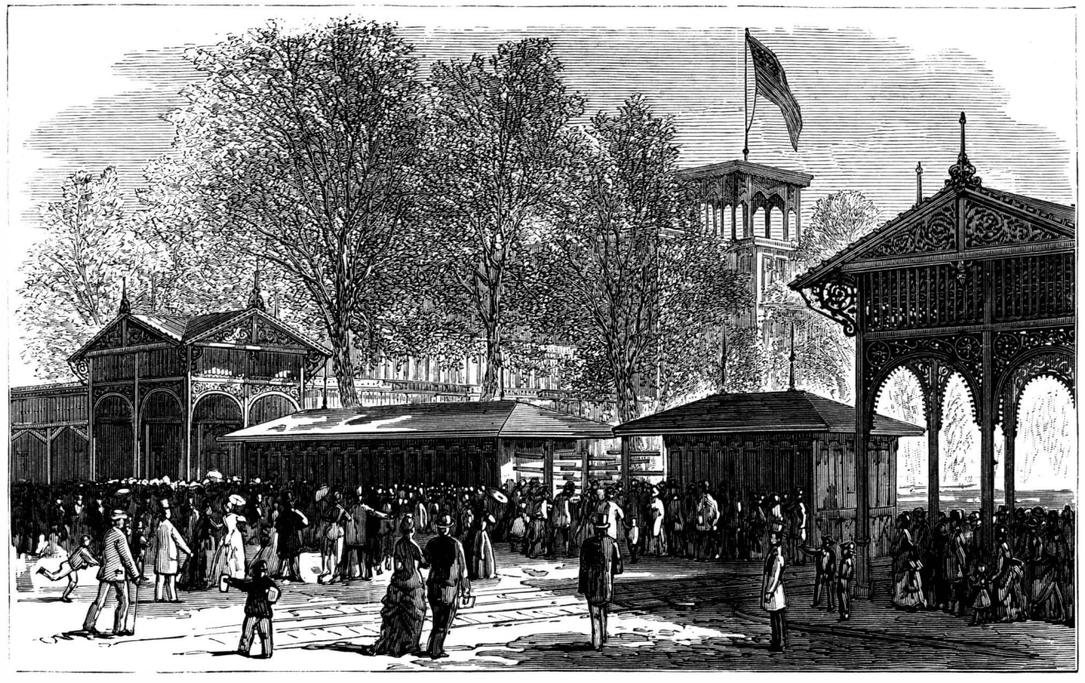
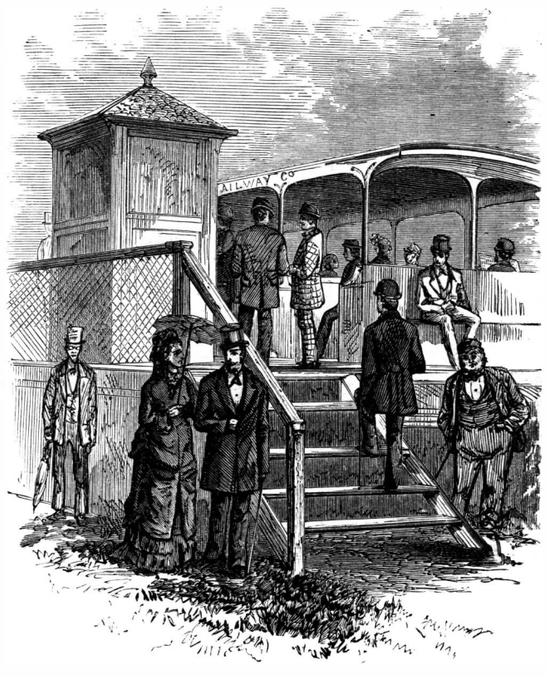
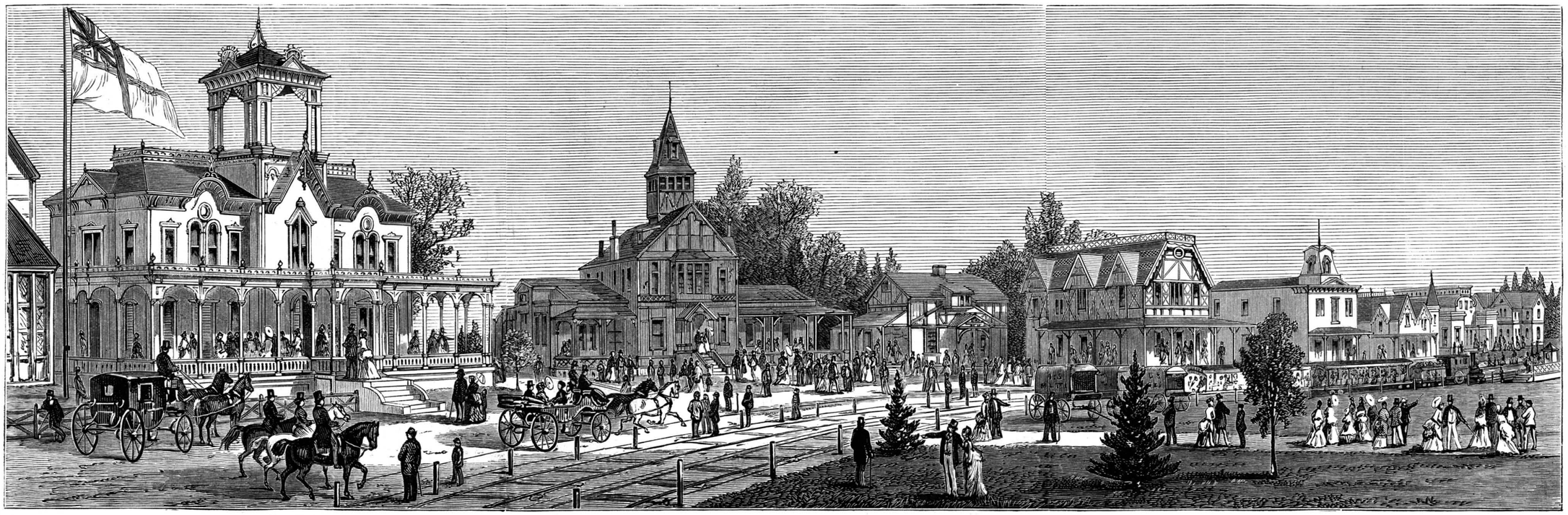
AT THE TURNSTILES.



ENTRANCE TO GRAND PLAZA—ELM AND BELMONT AVENUES



RAILWAY STATION, IN THE GROUNDS.



THE CENTENNIAL—STATE HEAD-QUARTERS, ON STATE AVENUE.—FROM SKETCHES BY THEO. R. DAVIS.

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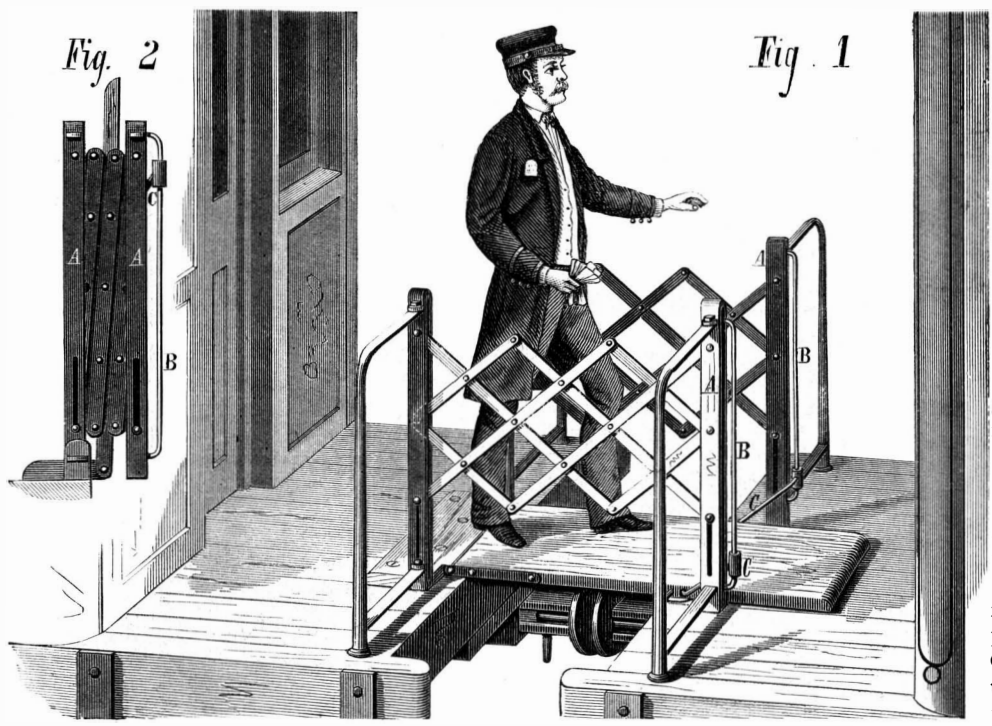
IMPROVED SAFETY BRIDGE FOR RAILROAD CARS.

The invention herewith illustrated is a gang plank and guard railing, designed for connecting car platforms, so that train employees and passengers can pass from car to car without danger while the same are in motion. The guards may be folded into a narrow compass so as to be out of the way when the cars are uncoupled.

The gang plank, Fig. 1, is hinged to an end piece which is rigidly secured to one platform, and is provided with fixed upright posts suitably connected to the platform railing. A pivoted guard rail extends along each side of the plank to movable upright posts, A, and is constructed in the form of lazy tongs, the folding of which is permitted through the lower ends playing in slots in the post, as shown in Fig. 2. The movable posts, A, are strapped to the platform railing, and are provided with guide rods, B, to which the gang plank is connected by swinging crank arms, C, shown in Fig. 2. These arms have sliding sleeves at their point of connection to the rods, B, so that the guards adjust themselves to the varying length of the platform during the motion of the train. They produce, when the gang plank is swung up, during the coupling or uncoupling of the cars, the simultaneous folding of the guard rail, and also the opening out of the same when the plank is lowered. The railing may be applied loosely to the platform or hinged to the fixed posts of the latter, so as to be swung sidewise. The device is equally well adapted to the gang planks of steamboats.

Patented through the Scientific American Patent Agency, May 16, 1876. For further particulars address the inventor, Captain L. F. Frazee, 194 Grand street, Jersey City, N. J.



FRAZEE'S SAFETY BRIDGE FOR RAILROAD CARS.

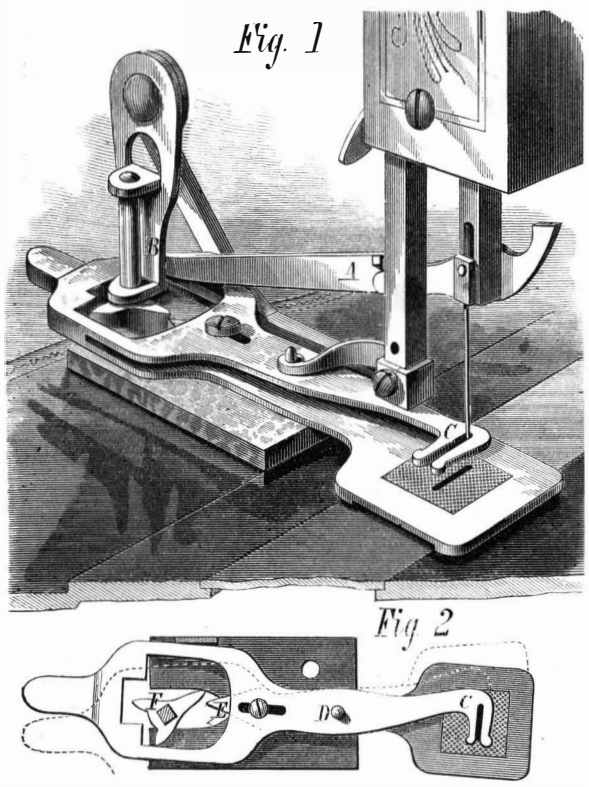
Captain Frazee will be remembered by many of our readers as the genial and popular captain of one of the steamboats that used to ply between New York and Long Branch.

Dyeing with Artificial Alizarin.

Forster proposes to add a fatty acid to the color, in order to produce upon cotton with artificial alizarin a red resembling Turkey red. He mordants with alumina, and dyes in an alizarin bath containing soap, neutralized with sulphuric acid. The mixture of alizarin and fatty acid, which separates out in fine flakes, dyes the tissues readily, and gives bright and solid colors—red, rose, and purple.

A NOVEL DEVICE FOR SEWING ON BUTTONS.

We illustrate herewith a very ingenious little attachment designed to render the sewing machine available for the sewing on of any kind of button. The device is simple and easily made and operated. In brief, it gives to the sewing machine a new capability, and for this reason will doubtless meet a ready welcome



It is obvious that, in order to give a button the necessary movement under the needle so that the latter can pass backward and forward from hole to hole, a different feed motion from that usually found in sewing machines is needed. And, moreover, such motion must be adjustable according to the distance between the holes in the button. This seems to be neatly accomplished in the present device.

A, Fig. 1, is an arm attached to the needle bar of the machine and jointed to the bar, B, which is pivoted to the inclined standard shown. C is the clamp for holding the work, and vibrates freely on the pivot, D, Fig. 2. Between the parts of the clamp is a bar, E, the pointed end of which protrudes into the opening in which is a cam, F, secured in a shaft which is attached to the bar, B. At each descent of the needle bar the cam, F, is carried backward, so that one or the other of its rear projections strikes the angles of the clamp plate, Fig. 2, and so turns its pointed forward end to either hand. When the needle bar rises the arm, A, swings the bar, B, forward, and the cam is carried in the same direction, so that it acts alternately first on one side and then on the other of the angle piece, E. This obviously vibrates the clamp and work under the needle. The piece, E, can be shifted along the plate and adjusted by the clamp screw shown, so as to regulate the throw of the clamp according to the distances between the holes of the buttons. The attachment can be adapted for use on any sewing machine, and is also suited for sewing on hooks and eyes, buckles, etc.

Patented through the Scientific American Patent Agency, April 4, 1876. For further particulars address the inventor, Mr. J. W. Fries, Salem, Forsyth county, N. C.

The Aquarium in New York City.

New York city is at last to have an aquarium. The subject of providing this most valuable means of study has been discussed repeatedly for the last ten years, and we, in common with others, have frequently advocated the establishment of a finny menagerie in Central Park. There is a probability of an aquarium being built in our great pleasure ground sometime in future; but before that collection is fairly begun, we doubtless will see finished the work recently started by private enterprise. The nearest approach to a large aquarium New York ever possessed was due to Mr. P. T. Barnum, who exhibited a number of tanks containing rare fish and a white whale (which some skeptics declared was of india rubber) in his old museum, which stood where the *Herald* building now is located. It is worthy of remark that to Mr. W. C. Coup, Mr. Barnum's former executive officer, is due the inception and undertaking of the present enterprise.

Work is already well advanced on the building, which is located on the plot of ground recently occupied by the Colosseum, at the corner of Broadway and 35th street. The edifice, says the *American Architect*, will be one story in hight, of brick, with large sash lights at the sides; and one immense skylight will form the roof. The tanks will be placed at a distance of three feet from the side walls, giving room for a passage, to accommodate pipes, and also to facilitate the passage of attendants. Light for the tanks will come from above, the spectator looking through a plate glass front. The sides of the tank are to be composed of slabs of slate, while rockwork will slant up at the rear. There will be a storage reservoir of a hundred thousand gallons, where a supply of salt water will be kept. This water will be conveyed from the river in barrels, and kept from stagnation by aeration, for which purpose air pumps worked by engines will be provided. The middle of the floor will be occupied by large tanks, built partly above and partly below the surface of the ground. These great tanks will be reserved for the white whale, sharks, and other large fish. Small tanks will be placed at convenient points; and when in running order, the establishment will be able to accommodate all classes of fresh and salt water fish.

Mr. Coup recently succeeded in capturing two white whales alive, in arctic waters, and in transporting them safely to a tank prepared for them in his building. Both, however, committed suicide in their endeavors to break through their narrow quarters, cutting themselves so severely, on projecting edges, that they bled to death.

Origin of Fiber in Puddled Iron.

The grain or absence of fiber is generally produced by the fusibility of the manganiferous or alkaline scoriæ, by the softness of carburetted or phosphuretted iron when heated, and by the high temperature at which the puddling is conducted; the fiber, on the other hand, results from the sparing fusibility of partially peroxidized scoriæ, and from the comparatively low temperature of the puddling.—*M. H. Le Chatellier.*

Historical Scientific Relics.

A remarkably interesting exhibition of scientific apparatus is now open in South Kensington, London. The enterprise was organized under government auspices, and is international. The collection includes not only apparatus for scientific research and for the teaching of science, but also any objects in any way connected with these. The end of the display is instruction and not advertisement, so that there is no competition and nothing in the shape of awards. Papers will, however, be read, descriptive of the articles exhibited.

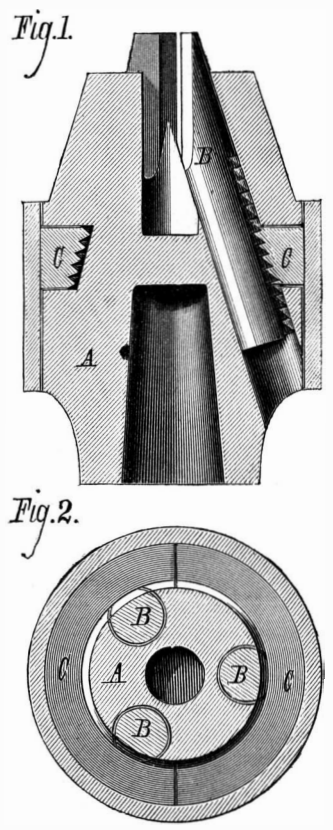
The most interesting part of the collection is that which includes modes and apparatus which are historical. Probably no such gathering of the results of the initial conceptions of some of the greatest discoveries and inventions in the world has ever before taken place. Among these are Bramah's original hydraulic press, the Comet, Puffing Billy, and Rocket engines; Newcomen's original model of his engine, a large collection of Watt's models, an unfinished steam cylinder made by Papin (1699), Sterling's model of his air engine, a link motion made by W. Howe in 1842, Symington's engine made for Dr. Miller in 1788 (the first engine used for steam navigation), the original model of the Eddystone lighthouse, and a bar lathe of Watt's. Still more interesting are the original apparatus with which Faraday obtained the magneto-electric spark; the original air pump and Magdeburg hemispheres of Otto Von Guericke, portions of the traces by which the horses were attached to one of the hemispheres being still left; also a stereoscope made by its inventor, Sir David Brewster, a "thunder house" made by Priestley, Galileo's telescope and several other of his instruments, Sir Francis Drake's astrolabe, the apparatus used by Joule in ascertaining the mechanical equivalent of heat, Black's pneumatic trough, a quadrant belonging to Tycho Brahe, a telescope by Huyghens, Babbage's calculating machine, Whitworth's original gages, the original Wheatstone bridges, and Armstrong's hydro-electric machine. There are hundreds of other exhibits, all connected with some great scientific achievement.

New Sulphate of Potassa.

The composition of this salt is: Sulphuric acid (SO_3) 44·9; potassa (KO), 50·6; water (HO), 4·6. The formula $SO_3KO + \frac{1}{2}HO$ would require: Sulphuric acid, 43·7; potassa, 51·3; water, 5·0.—*M. J. Ogier.*

ALMOND'S IMPROVED DRILL CHUCK.

We illustrate herewith a new and simple drill chuck, so constructed that the jaws have a large amount of bearing surface, and hence will keep true for a long period, that no dirt can enter the working parts, and that there is a direct connection between the jaws and the machine spindle, so that the parts become, it is claimed, as one piece.



The body of the chuck, A, Fig. 1, is turned of 1⅛-inch steel and is pierced with three guideways to receive the jaws, B. These are made of Stub's best wire, hardened at the gripping ends, and with the temper drawn to a blue at the part where the screw thread is cut. The thread engages with a corresponding thread in the embracing nut, C made and applied in halves as shown in Fig. 2. As the curves are alike, the jaws are prevented from turning on their own axes, although they are free to move endwise and towards the center, when the nut is revolved. The nut is hardened to a temper corresponding to the threaded part of the jaws. The latter have a slight twist, so that the tendency of the drill in the work acts to tighten their edges on the tool rather than to loosen them. The device, as a whole, is durable, compact, and cheap; and since all its parts are cylindrical and produced in the lathe, they may be easily duplicated.

Patented by Mr. T. R. Almond, February 8, 1876. For further particulars address the agent, J. M. Montgomery, 105 Fulton street, New York city. See advertisement in another column.

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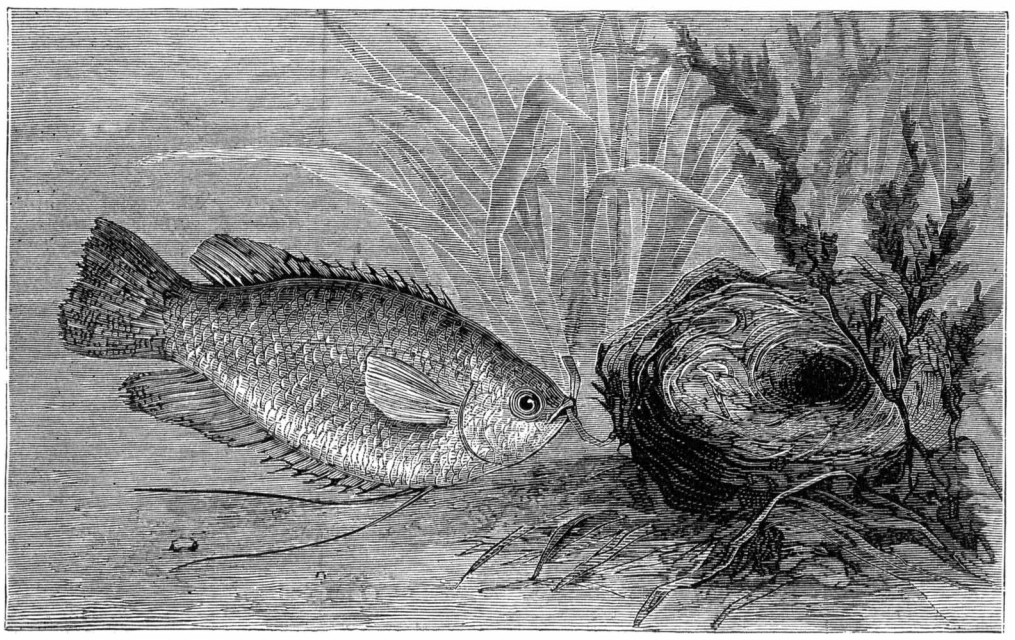
NEST-BUILDING FISHES.

The *anabatidæ* form one of the most remarkable of all species of fishes, owing to their capability of living for a long time out of water, a power which has formed in them some curious habits. The *anabas scandens*, or climbing perch, of India, has been known to live for six days out of its appropriate element; and some will sometimes quit the water and wander over the land, so far from any stream or pond that they were formerly supposed to have dropped from the clouds. The German naturalist Daldorff states that he once saw one of this species which had climbed a tree to a hight of five feet; but this is stated by other observers to be an impossibility. This power is due to the peculiar structure of the pharyngeal bones, which, in a cavity in the base of the skull, are dilated into voluminous *laminæ*, forming cells in which a supply of water may be carried for the purpose of keeping the gills moist.

But the gourami's instinct is more peculiar than that of any other member of the tribe. By their united labors, the male and female construct a well built nest, in which the ova are deposited, and which protects the young fry from the thousand enemies by whom infantile fish are pursued and tormented.

The body of the gourami is of a brownish color, varied with some golden tints on its sides; the belly is of a silvery brown. The conformation of the fish is high from its belly to back, and the body is narrow; the head is short, the mouth small and protractile. The scales are large and round. The fish is properly herbivorous, but will eat insects and earth worms; and it is so voracious that, says M. Dabry de Thiersant, the creoles of the Mauritius call it the hog of the river.



THE GOURAMI (OSPHRONEMUS OLFAX).

The gourami, like most other *anabatidæ*, is found throughout the East Indies, and is a valuable food fish of delicious flavor, resembling that of the European carp.

Many attempts have been made by the French to acclimatize it on this continent, especially in Cayenne; but little success has been met with. In Algiers, other attempts have been made, and greater encouragement followed. At the Cape of Good Hope and in Australia, the experiments were entirely successful.

Our engraving of the gourami and its nest is selected from the pages of *La Nature*.

THE SCORPIONS OF EGYPT.

That indefatigable naturalist, Mr. Frank Buckland, has recently published the following account of a fight between a mouse and a scorpion, the illustration (representing the thick of the combat) having been drawn on the spot by a spectator:

"In February, 1868, I received a box by post containing two live scorpions, kindlly presented to me by my friend, the late lamented J. Keast Lord, who had caught them under a stone at Heliopolis, in Egypt. Wishing to test the power of the scorpion's sting, I got a glass globe and turned in one of the scorpions. A mouse having been caught in the trap, I thought I might just as well let the scorpion try his powers upon it as the cat. I therefore shook the mouse into the glass with the scorpion. The scorpion, an average-sized one, immediately resisted the affront; and the mouse, who had never evidently seen a scorpion before, did not know whether he was his friend or his enemy. Not liking the continued jumpings of the mouse, the scorpion twisted and began brandishing about his sting. The mouse shortly crossed his path. The scorpion instantly lunged his sting into him. This challenge woke up the mouse, who began to jump up and down like a jack in the box. When he became quiet, the scorpion again attacked the enemy, with his claws extended like the pictures of the scorpion in the zodiac. He made another shot at the mouse, but missed him. I then called 'Time!' to give both combatants a rest. When the mouse had got his wind, I stirred up the scorpion once more, and, as 'the fancy' say, 'he came up smiling.' The mouse during the interval had evidently made up his mind that he would have to fight, and not strike his colors to a scorpion as he would to a cat. When, therefore, the scorpion came within range, the mouse gave a squeak and bit him on the back; the scorpion at the same moment planted his sting well between the mouse's ears on the top of his head (see engraving). The scorpion then tried to retreat, but could not, for one claw had got entangled in the fur of the mouse. The mouse and scorpion then closed, and rolled over each other like two cats fighting, the scorpion continually stabbing the mouse with his sting, his tail going with the velocity of a needle in a sewing machine. When the scorpion got tired, the mouse got hold of his tail with his teeth and gave it a sharp nip. The mouse seized the opportunity, and immediately bit off two of the scorpion's side legs. He then retired, and began to wash his face. I had expected, of course, that the poison of the scorpion would have killed the mouse, but he didn't seem a bit the worse for it. When I examined him the next morning, he was quite lively and well; and had nearly eaten up the whole of the scorpion for his breakfast. Of course I rewarded the mouse for his plucky conduct by giving him some milk, and by letting him go in a place where it was not likely the cat would find him.

"Scorpions are inhabitants of hot climates; they live among stones, logs of wood, etc., in such places, in fact, as those inhabited in England by wood lice and centipedes, etc. They are said to attain the length of twelve inches in Batavia; and along the Gold Coast, I have heard (but hardly believe it) they are found as big as a good sized lobster; the general size is about three inches long. It not unfrequently happens that scorpions are brought to England in timber ships, etc., and I have received more than one scorpion thus brought over."

FIGHT BETWEEN A SCORPION AND A MOUSE.

Lily Culture.

Much non-success in the cultivation of lilies arises from working in too much fresh manure, which has come in contact with the bulbs and caused them to decay. If the following treatment is given them, but little fear of failure need be apprehended: In the fall, after the stems are ripened off or killed down with frost, lift all the bulbs; and if the soil is of a loamy nature, procure some fresh muck (the most preferable being that in which the native lily luxuriates) and shake all roots or weeds, etc., out of it; then put a good covering of it on the bed, also a good manuring of well decayed manure, and trench the bed about 18 inches deep, keeping the manure well to the bottom of the trench, so that most of it shall be below the base of the bulbs, incorporating at the same time the peat or muck well with the soil. After the trenching is done, level the bed on the surface, and plant the bulbs in rows, about one foot apart for small bulbs, larger ones further, and about the same distance in the rows, putting them into the ground from six to eight inches deep. Before severe frosts set in, cover with a good protection of rough horse manure or any such material, which will help to keep them from getting too much frost. In the spring, before the bulbs start, remove the covering and they will come up strong and vigorous. When planting the bulbs, surround each one with a good handful of river sand.—*Cultivator and Country Gentleman.*

To remove grease stains from silk hats, use first turpentine and then alcohol.

Naphtha, Benzine, and Gasoline.

The distinction between the three above-named articles, which exists only in degree of their specific gravity, is clearly set forth in *The Grocer* as follows:

"Among the chief products of petroleum, which enter largely into every-day trade, and about which very little is known even by those who handle them, are naphtha, benzine, and gasoline, all of which are the first results of the distillation of petroleum. The application of the three names is oftentimes confused, though there is a practical difference between the products, which may be easily determined by the simple use of an hydrometer. The first result of petroleum distillation shows a gravity of 90°, and the distillation from that down to 80° gives what is known as gasoline, which is used almost exclusively in patent gas machines for the manufacture of burning gas, a very fine light being obtained from its use. It is also employed as a carbonizer of coal gas, and, when properly applied at the meter, and with improved burners, it adds greatly to the richness of the flame. The gas companies use gasoline as an admixture for their product, in which case it becomes an adulterant, because of the imperfect means employed in its use.

The distillation from about 74° down to 68° is termed benzine, which is largely used by painters as a substitute for spirits of turpentine; the latter, being more oily, produces a much heavier paint, giving a better finish and being much more durable, but benzine is a quick dryer, and, being cheap, is especially adapted to rapid and low-priced work. The scouring establishments also use very large quantities of this product, and it is deodorized and sold in small bottles, under various names, for removing grease from clothing and similar purposes. When first taken from the still it is highly odorous, and that disagreeable feature is only removed by means of re-distillation and treatment with sulphuric acid. The goods that are bottled and retailed in that way frequently have some fragrant perfume added to counteract the pungent odor, which cannot be entirely removed from the benzine by any manner of treatment. Benzine is sometimes used for burning, but is exceedingly dangerous, and should never be employed for that purpose.

The heavier gravity product of the still, ranging from 62° to 65°, is termed naphtha, and is the lowest distillation unmixed with oil, which distils over at about 62°. Naphtha is used in the manufacture of varnish, oil cloths, and patent leathers. It is also largely employed in connection with india rubber, of which it is the only perfect solvent, being vastly superior to spirits of turpentine. We have shown in this brief space the proper gravity of these different products, and persons who have occasion to use any of them can easily protect themselves against impositions by applying the hydrometer test to which we have already alluded.

The finer burning oils are made from distillation ranging from 51° down to 45°. Most of the high test oils show a gravity of about 47° to 48°, but this is too heavy for a very fine free-burning oil, and the finest product made has a gravity test of 50°, and a fire test of 150° Fah. This gives a perfect light, and may be used with absolute safety. The low priced kerosene oils, testing down as low as 110° Fah., and under, and of 46° to 48°, are being superseded by the better grades; and the good results are shown in the very rare reports of injury to life or limb from the use of an article which, because of its impurity and danger was, a few years ago, very generally condemned."

Cleaning Silk.

The following mode of cleaning silk garments has been successfully tested. The garment must first be ripped and dusted. Have a large flat board; over it spread an old sheet. Take half a cup ox gall, half a cup ammonia, and half a pint tepid soft water. Sponge the silk with this on both sides, especially the soiled spots. Having finished sponging, roll it on a round stick like a broom handle, being careful not to have any wrinkles. Silk thus washed, and thoroughly dried, needs no ironing and has a luster like new silk. Not only silk but merino, barège, or any woolen goods, may be thus treated with the best results

FOR the benefit of people who, like a large proportion of the inhabitants of this city, reside in localities where disagreeable odors from slaughterhouses, oil works, or bone boiling establishments are prevalent, we have tried various fumigating compounds,such as pastilles, etc., in order to determine which best overcomes such stenches. We find none so efficacious as simple burnt coffee. Grind the roasted berries moderately fine, moisten the powder slightly, and throw 1 oz. or so on a pan of hot coals. The odor seems to remain in a room even when the windows are opened.

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A NEW METHOD OF MAKING SURFACE PLATES.

BY JOSHUA ROSE.

It has been for many years accepted as an indisputable fact that a true surface plate could only be produced by means of hand scraping. Now the hand scraper in reality makes a series of shallow cavities, the tops between the cavities having a surface bearing. The finer the scraper, the greater is the number of cavities, and therefore the greater is the number of bearing spots; so that a finely fitted pair of surface plates present the appearance of closely dotted bright bearing surfaces combined with adjacent scraper marks which had no bearing. The depth of a majority of these marks is undoubtedly veryslig ht; but any one who has used a surface plate for any length of time is aware that, while after a time most of the scraper marks become effaced, yet many of them remain, demonstrating that some of them were deeper than others: and this is sure to be case, no matter how carefully the scraping be performed, because the scraper is not at all times equally sharp, and hence cuts deeper at some times than at others. The difference may, it is true, be very slight, but still it exists, and is a detriment to the amount of its extent. Scraped surface plates may be made so nearly true that a plate, say 12x8 inches, will lift 2 lbs. per inch on a small surface applied to a large one, or the two plates of the size mentioned will have between them a vacuum of about ½ lb. per inch of area when one completely covers the area of the other, and of about 1¼ lbs. per inch when one surface only covers one half of the other: while, when one surface covers one third of the other, the vacuum will be increased to about 1½ lbs. per square inch of the surface in contact. It must, however, be a well scraped surface to give results of such a standard of excellence.

In the early days of the mechanic's art, surface plates were finished by grinding them together with fine emery; this, however, was found objectionable, in that the softer parts of the iron would grind away more quickly; and as no method of overcoming this defect was discovered, the practice of scraping was introduced, and it has held its own to this day as the most perfect method of obtaining a true surface, notwithstanding that it produces simply an area of fine hills and hollows. These hills and hollows may be sensibly leveled by well rubbing the plates together, it is true; but cast iron, of which it is found most desirable to make surface plates, wears under such conditions, so that a very hard skin is formed upon the contacting high spots, and they finally get very bright and so hard that it is impracticable to wear away the high places. If a plate of cast iron, after having been finished, is well rubbed upon a wrought iron or brass true surface, the high spots upon the cast iron will abrade much more rapidly, but still not sufficently to render it practicable to abrade the surface so as to efface the scraper marks, and still keep the surface plates practically true.

Surface plates of wrought iron may be scraped true, and then rubbed together until the scraper marks are very nearly all effaced; but such plates are very subject to wear, and consequently soon get out of true. Scraped surface plates of cast iron have therefore, hitherto, been the only ones made. Some three weeks ago, however, a mechanical correspondent of the SCIENTIFIC AMERICAN wrote to the editors a letter enquiring what were the specific objections to getting up surface plates with files and emery paper; and the enquiry was handed to me to answer in the columns of "Answers to Correspondents." The first impulse was to reply that true work could not be produced by the use of files and emery cloth or paper. Upon further consideration, however, the conclusion was reached that it was practicable to make, with such tools, surface plates superior to those produced by the scraping process. Having then in my possession a little surface plate made at the Freeland tool works, which plate was one of a pair exhibited at the American Institute Fair in 1873, and having also the mate to the above, which had been in use for some time, and was deeply scratched all over and indented in several places by careless use, I took the latter and smooth-filed it all over until the indentations and scratches were effaced, and then commenced the truing, using the new plate to test with. When the marks showed that the plate under operation bore about equally all over, a superfine smooth file was used until the previous file marks were obliterated, and the test marks again showed about evenly in all parts of the plate. Here it may be well to observe that it is not to be supposed that the flat surfaces of these files were used indiscriminately upon the surface under operation. Each file was chalked before being applied to the work, and then a few light stroke of the file were made; after which the teeth of the file were closely examined for the dark spots, which spots indicated which teeth stood the highest. Then only such parts of the file were used as showed the teeth in the middle of the width of the file to be cutting, and which were cutting without any action of the teeth beyond them after passing an area of teeth which were not cutting. By this means I could so place the file that the cutting teeth had contact with the part of the surface requiring to be filed, and yet be assured that no other part of the file was doing execution. An 8 inch Grobet file, of the finest cut, was the next one used, a dead smooth not being at hand. The advantage of using a Stubs' dead smooth would have consisted in that Stubs' and other dead smooth files are made harder than the superfine dead smooths of Grobet, which latter, applied upon a cast iron surface, soon lose their grip, because they are not made sufficiently hard for such duty. They are, however, the truest cut files I have ever handled, and suited my purpose admirably. After having, with the Grobet file, effaced all the marks made by the superfine smooth file, and fitted the plates until the marks showed evenly all over. No. 1 French emery paper was applied, first lengthwise and then crosswise of the plate. The paper was wrapped, in not more than two folds, around the file, which was done to preserve the edges of the plate from becoming rounded from the action of the emery paper. Care was also taken not to rub the emery paper too much upon the edges of the plate, for fear of rounding them; because rounding these edges would have rendered it impracticable to have finished them without scratching the surfaces, for the following reasons: No matter how much care is exercised, two plates having very smooth surfaces cannot be put together by placing one on top of the other, and then worked without scratching their surfaces; because the very dust in the air will be sufficient, upon such fine faces, to deeply score them. The proper way is to clean the face under operation with an old linen rag, and the test plate with a piece of rag about two inches square that has had two drops of oil put on it. After cleaning them, the palm of the hand should be passed all over the test plate, and then it must be wiped with a piece of clean rag and again applied to the test plate, this process being repeated several times, so that the amount of oil upon the test plate shall be barely sufficient to tarnish it. Then we pass the hand over the plate under operation to remove any particles of dust, and apply the test plate, putting it on one corner of the other, balancing it until its surface is level with the other (the two faces contacting over about an inch of area); and then, while pressing the faces together, we slide the top plate horizontally over the lower one. Then, if the edges of both plates are true and sharp, they will remove from the surfaces of both plates those particles of dust which would slide under a rounded edge, and get between the surfaces and scratch them. Our next operation is to move the test plate upon the lower one, backwards and forwards as well as sideways, until the marking spots which were at first dark have become bright through abrasion. The emery-papering process is to be continued until the file marks are effaced all over the plate; while at the same time the test surface plate marks are distributed evenly all over, that is to say, in spots of about equal area and at equal distances apart.

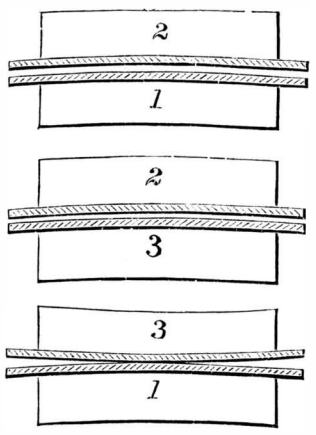
The next procedure is to find a means to apply the emery, cloth to the high spots, where the test plate marks showed without touching the unmarked spaces between them, which is to be accomplished by wrapping small pieces of No. 1 French emery paper around a small piece of round wood, of about ½ inch in diameter, the sharp corner being chamfered off for a distance of about ⅜ inch. The emery paper should not make more than two complete circles of covering around the wood, and should be brought to bear upon the plate at the chamfered edge of the wood. To prevent the emery paper from cutting in lines, it is moved in circles, say ⅜ inch diameter, and pressed firmly upon the plate upon the bright marking spots. By this motion, I find the emery paper is less liable to cut out the softer parts of the grain of the iron; while at the same time, another advantage is gained in the fact that, the surface of emery paper in contact with the plate being less than ¼ square inch, it cuts very freely at first, but becomes glazed very rapidly, and polished after the first few strokes, an action which renders necessary a frequent moving of the paper upon the wood but is in every way desirable. After the whole of the marks left by the test have been operated upon in this manner, care being taken to operate more freely on those spots where the test marks were the heaviest, the process is continued with No. 1 French emery paper, and subsequently with numbers 00, 000, and 0000, commencing by using the 0 grade upon a file and rubbing it lengthwise and crosswise of the plate, and finishing by the piece of wood and circular motion. Grade 00 is first applied in very short strokes of the file, taking care that the paper near the end of the file only is used, so that it can be brought to bear upon the required spots only, the finishing being performed as before. During the use of the 000 and 0000 emery paper, the test plate is not supplied with any lubricant whatever, but is kept bright and clean and rubbed until the marking upon the plate under operation has a shining area only; until at last it becomes impossible to detect that the test plate bore any harder on one place than another, the vacuum between the two being but little greater than that obtained between two finely scraped surfaces. A fine film of oil is then to be placed upon the test plate, which is then freely applied in order to give it a better bearing if possible. This object was, in the first case, only partially successful, however, since it was too tedious. After some little consideration I determined to pass a piece of fine oilstone over the surface; and selecting a piece with an unusually fine grain, I filed its surface flat and beveled off one edge to a broad bevel; then taking a separate piece of cast iron, I wore the bevel and the face of the oilstone true, and applied first the flat face of the oilstone to my surface plate. But I found that it had no effect whatever, although applied with considerable pressure. The beveled edge of the stone was then applied, and it had the effect of slightly dulling the polished surface. Upon again applying the test plate, I found the vacuum was increased; but the surface did not work quite so evenly, and 0000 emery paper moved in circles was again brought into requisition, with the result that the vacuum became so great that it was only with great difficulty that the upper plate could be moved horizontally upon the lower one, that is, providing that they were put together as before described. If, however, they were put together without being pressed one to the other, the film of air between them would cause the upper one to glide about like a piece of ice placed upon smooth ice.

It now became a problem as to how to finally finish the surface. The marking appeared as a continuous glaze all over, there being apparently no high or low spots; and yet the color of the metal appeared slightly varied in places, notwithstanding that the surface was bright and smooth to a high degree. Continuous rubbing of the plates together was at first tried, but without apparent effect, since the bearing seemed equal all over. The plates were then put together, allowing a film of air to be between them, and one plate to, as it were, float upon the other; the top one was then touched sufficiently to set it in motion, in all directions; and if any one part of the plate was found to act as a center of motion more frequently than the others, out of a test of about twenty motions, that part was very lightly touched with worn emery paper of the 0000 grade.

The result thus obtained is as follows: The plates in question are 12 by 8 inches; and placed one fairly over the other, it takes 200 lbs. to pull them apart vertically and about 150 lbs. to move one horizontally upon the other. A small piece of cast iron surfaced on an area of 7 inches will maintain on either of the plates a vacuum of 5 lbs. per inch of area.

These plates are now in the Machinery Hall of the Centennial, and may be seen in the space occupied by the Putnam Machine Company.

For the benefit of those who may desire to make a surface plate, it may be as well to here describe the method by which it may be obtained. First, then, the plates should be provided on the back with three resting points, two being at one end (one near each corner of the plate) and the other being at the opposite end and in the middle of the width of the plate. By this arrangement, the plate will lie on the bench resting at all times on three points, without rocking, even though the surface of the bench be uneven: which plan will protect the plate from the deflection due to its own weight. Between these resting points, there should be ribs to support the plate and to prevent still further deflection. In the Whitworth plates, these ribs run straight from each resting point to the others, thus forming a triangle, and cross ribs are also introduced. The plates, three in number, which we will designate as Nos. 1, 2, and 3, should be placed first on the three resting feet, and then on the edges and lastly on the faces. Nos. 1 and 2 are first fitted together and then No. 2 is fitted to No. 3. Now it is obvious that, in fitting No. 1 to No. 2, we have had nothing to guide us as to



making either surface true. One plate may bear upon two diagonal corners only, while the other may bear upon all four corners or all round the edges. In this case, we know that the one bearing upon two corners only is atwist, but the other may be hollow, or both may be hollow. Still we have no alternative but to fit them together. We may, it is true, test both surfaces with a straight edge, which must be used as follows: It should be wiped quite clean and placed upon the surface plate in various positions, as lengthwise, crosswise, and across the corners of the plate; and while in each position, we must take hold of one end, and, without placing any vertical pressure upon it, move it laterally back and forth a little, say about two inches, to see where it takes a fulcrum on the surface of the plate. If the center of its movement is at the center of the surface plate, then the surface of the plate is rounded, or highest in the middle. If it moves on the plate, first most at one end and then most at the other, the surface is hollow; while if it moves with an irregular and shuffling movement, it denotes that the surface is as true as the straight edge will test. Plates 1 and 2 having been fitted together, we take No. 2 and fit it to No. 3, not operating upon No. 2 at all. We next take No. 3, and try it to No. 1. Now if 3 and 1, when tried together, show each other to be rounded, it is proof that No. 1 is rounding to half the amount of difference between it and No. 3, as shown in our engraving, from which it will be observed that the two nearest together faces of Nos. 1 and 2 may fit together, one being rounded and the other hollow. No. 2 may be taken as a gage whereby to fit No. 3, their surfaces being made to fit perfectly. But if we take No. 3, and apply it to No. 1, they will disagree to twice the amount that No. 1 varies from a true, flat surface. We next refit Nos. 1 and 3 together, taking, as nearly as we can judge, an equal amount off each of them; and then taking No. 1, we recommence and fit No. 2 to No. 1, No. 3 to No. 2, and finally No. 3 to No. 1, taking half the amount of difference, between them, off each; and we then repeat the whole operation until all three plates applied indiscriminately fit each other perfectly.

REPEATED applications to copper or brass of alternate washes of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze.

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The Civil Engineers' Convention at Philadelphia.

The eighth annual convention of the American Society of Civil Engineers is now in session in the Judges' Hall at the Centennial. The meeting opened on the 13th of June, Mr. G. S. Greene, C.E., of New York, presiding. Among the papers thus far read is one by Mr. T. G. Ellis, of Hartford, on the Centennial History of Engineering, in which he reviewed progress in this science over the past century. All the facts presented by Mr. Ellis have been fully noted by us in the series of editorials in American progress which recently appeared in these columns. The first regular business transacted by the members was the discussion of a previously published essay, by Mr. C. Bender, on the theory of continuous girders in relation to economy in bridge building. Mr. Pettit, architect of the Main Exhibition Building, read a paper on the character of the engineering work, therein giving the reasons for the adoption of the plan selected. The peculiarity of construction is that it is like the framework of a table. The long iron supports carry the dead weight, and the trusses resist the side pressure. A good test of its stability was made in February last, when a wind having a pressure of 18 lbs. per square foot caused no perceptible vibration. The amount of iron used was 8,340,000 lbs. The iron, flat, angle, and round, measures 141 miles in length and if made into a cubic block, it would measure 25 feet 10½ inches on each edge. There is 1 square foot of glass for each 4 square feet of surface covered. Mr. Pettit also described the general plan of installation of exhibits; and Mr. Schwartzmann, architect of Memorial Hall, explained his construction of that edifice. Complete abstracts of all papers read will appear in the SCIENTIFIC AMERICAN SUPPLEMENT.

Correspondence.

The Locust Pest.

To the Editor of the Scientific American:

The facts mentioned by your correspondent J. F. Dunwoody, of Louisiana, Mo., are interesting, and, for one, I am always glad to get such exceptional facts; but they do not invalidate the other facts recorded by me in the article on locust prospects from which you condensed in a recent number. That locust eggs are destroyed by excessive moisture, and especially by alternately soaking and drying, I have abundantly proved by experiment; and I do not doubt the correctness of the observations of the Minnesota Commission. My conclusions as to locust injuries in 1876 are also most thoroughly substantiated by the experience of the past two months, which, considering the contrary opinions very generally entertained and promulgated last winter, is very strong proof of the correctness of the statements upon which my opinions were based. It is not improbable that eggs in a tenacious slough bottom, continuously covered with water for months, would suffer less than those alternately soaked and dried in a porous soil, on the same principle that vegetation under like conditions would rot sooner in the latter case; and if Mr. Dunwoody were to state the circumstances attending the fact he mentions with more explicitness, so that we could know the nature of the slough bottom, and feel confident that the locusts observed subsequently to its drying up actually hatched there from eggs laid before it was overflowed, we should without doubt find that his observation admits of an explanation in harmony with the opinions which he thinks it invalidates.

As to freezing, the eggs, as I have shown in my own writings, will withstand with impunity almost any amount of it, and the young locusts may also be frozen in solid ice and yet live; but the fact nevertheless remains, and is supported by such extensive experience as not to be gainsaid, that, when the young of the Rocky Mountain species prematurely hatch in fall or during mild winter weather, they are subsequently destroyed by continued severe freezing, or by continued freezing and thawing.

St. Louis, Mo. C. V. RILEY.

Remarkable Example of Spontaneous Combustion.

To the Editor of the Scientific American:

A singular instance of spontaneous ignition took place in my house some time ago. On entering the house about noon, I detected the smell of something burning. An immediate search was made, and upon entering the parlor I noticed smoke rising from a center table that was placed near a south window. I stepped up to the table and noticed some pieces of cotton goods on fire, which I smothered out with my hand. Alongside of the goods that were on fire lay a stereoscopic instrument that was exposed to the direct rays of the hot noonday sun. It so happened that such was the position of the two lenses that they caused a burning focus on the goods and set it on fire. Had we been absent till an hour later, the fire would have extended itself, to the destruction of the house and all that was in it.

Round Mount, Texas. G. P. HACHENBERG, M. D.

[Accidental fires produced by lenses have frequently come to our notice. The glass globes filled with water and used to contain gold fish will converge the sun's rays to a focus of sufficient intensity to ignite light materials, and have thus started incipient conflagrations. The heavy glass bulls-eyes sometimes used for dead lights in ships have also produced similar effects; and we once called attention to a remarkable case where a bulb of glass, formed in a large sheet used as a window pane in a store, and due to a defect in the manufacture, proved the means of setting fire to objects displayed inside. Druggists' show globes of colored water also form powerful lenses, and we once knew of an enterprising apothecary who employed them as a cheap source of heat for his distilling apparatus. Of course there have been many attempts to utilize the high temperature of the sun's converged rays. Huge mirrors have been built to melt refractory substances. Ericsson has devised a solar engine, and probably the latest invention of the kind is M. Mouchot's solar boiler, where the steam generator is placed in the focus of a concave reflector.—EDS.]

THE *Scientific Farmer* says that the best way to prevent overheating of compost is to pack the surface down solidly, by simply treading upon the heap with the feet (after pulverization), or, still better, to spread a little earth over the pile, taking care to pack it somewhat. Either method tends to exclude air, and thus prevents too rapid oxidation.

NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF PHYSICAL MANIPULATION. By Edward C. Pickering, Thayer Professor of Physics in the Massachusetts Institute of Technology. Part II. Price $4. New York city: Hurd and Houghton, 13 Astor Place.

Professor E. C. Pickering's first volume was received with general favor. He has now largely extended the scope of the work, and has introduced subjects not usually considered to belong to the domain of pure physics. The new volume contains an admirable chapter on mechanical engineering, including details of boilers, steam pipes, and indicator diagrams, as well as articles on speed and friction of shafting, belts, and pulleys. The friction brake and transmission dynamometer are fully explained: and some valuable methods of testing speeds of piston rods, shafts, and fly wheels, which are, we believe, entirely new, are described and illustrated. The apparatus employed in the growing science of meteorology occupies one of the most interesting chapters in the book; and the section headed "Practical Astronomy" contains a clear description of the instruments in common use for nautical and stellar observation. Tables of squares, cubes, powers, logarithms, tangents, and sines, and of the properties of metals, liquids, gases, and vapors, are added in appendices, with full explanations. The description of a good physical laboratory and a list of test experiments for students' use complete the work. The laboratory described is that under the charge of the writer, in which about 100 students are instructed every year. We cordially commend the work to all teachers of science classes, as one which they should study themselves and place in the hands of their pupils.

HANDBOOK OF ELECTRICAL DIAGRAMS AND CONNECTIONS. By Charles H. Davis and Frank B. Rae. Price $1.50. New York city: The Graphic Company, Park place.

The authors of this work are employees of the Western Union Telegraph Company in this city; and by their joint labor, they have produced a book of the highest value to the telegraph profession. It contains engravings of all the instruments (single, duplex, etc.), relays, batteries, etc., in ordinary use, with well written and detailed descriptions. The historical portions of the book are especially commendable for their accuracy, and for their fairness to the many claimants to the credit of originating the telegraph and its details, who are frequently so numerous and so contradictory as to bewilder the reader. Thirty plates and a map of the world showing all the telegraph cables in existence are added, all being executed by photolithography, in the best style of the art. The work is one of the most complete and useful handbooks we have seen for some time.

THE INFLUENCE OF THE BLUE RAY OF THE SUNLIGHT AND OF THE BLUE COLOR OF THE SKY, IN DEVELOPING ANIMAL AND VEGETABLE LIFE, ETC., as Illustrated by the Experiments of General A. J. Pleasonton and others. Philadelphia, Pa.: Claxton, Remsen, and Haffelfinger.

A good description of the purport and matter of this remarkable work appears in an article on p. 388 of our volume XXXIV. We have little to add to the description there published, except that the book itself is more eccentric than we could have believed, unless guided by a perusal of its contents. The incidents of the cure of rheumatism in a mule by putting panes of blue and colorless glass in the transom window of its stable, the cure of a woman suffering from a complication of undescribed disorders by a similar application, the cure of spinal disease by use of a bath of blue light, and many similar cases cited by the author, remove this book beyond the sphere of legitimate criticism, and place it among the many melancholy burlesques of science and inductive investigation, by the publication of which certain authors are now trying to obtain notoriety.

PRACTICAL TREATISE ON THE CONSTRUCTION OF IRON HIGHWAY BRIDGES, with a Short Essay on the Application of the Principle of the Lever to the Analysis of Strains. By Alfred M. Boller, A. M., Civil Engineer. Price $2.50. New York city: John Wiley & Sons, 15 Astor Place.

The author states in his preface that he intends this work for the use of town committees; and he has succeeded in producing a work that will be useful to any such bodies having to provide for the construction of bridges. The points to be regarded in designing an efficient structure are enumerated and fully described; and the author's cautious advice regarding specifications and contracts will, if followed, relieve local authorities from much responsibility as to the security of the work. The book is likely to disseminate some practical knowledge of great value and importance.

THE CENTENNIAL NEWSPAPER EXHIBITION, in Fairmount Park, Philadelphia. New York city: George P. Rowell & Co., Park Row.

The publishers of this volume own the well known extensive advertising agency in this city, and the admirable display of American newspaper literature at the Centennial is due to their zeal and enterprise. A description of the very large and varied exhibit of our newspapers and the statistics of American journalism will be found in this handbook, which should be read by every visitor to the Centennial Exhibition, who will find in the Newspaper Building one of the most attractive displays to be found in the whole show.

CHEMISTRY, THEORETICAL, PRACTICAL, AND ANALYTICAL, as Applied to Arts and Manufactures. Parts V. to X. Philadelphia, Pa.: J. B. Lippincott & Co., 715 Market street.

The publication of this work was announced when the first four numbers reached us; and the subsequent ones need no comment, being printed in similarly handsome style, with the same characteristics. We must, however, again protest against the concealment of the names of the compilers. Twenty dollars is too much to pay for a book which does not establish its authenticity and accuracy by giving information as to its authorship.

PRINCIPLES OF APPROXIMATE COMPUTATIONS. By Joseph J. Skinner, C. E., Instructor in Mathematics in the Sheffield Scientific School of Yale College. New York city: Henry Holt & Co.

This treatise is likely to prove of especial value in solving those numerous problems which involve repeating decimals, as well those in which occur measurements with instruments capable of giving only a limited degree of precision. These difficulties are dealt with by the author in a very practical manner; and his method produces results which are little at variance with those obtained by continued calculation.

THE AMERICAN SYSTEM, GERMAN. A Record of Professor C. C. Schaeffer's High School Test Course. Philadelphia, Pa: Charles, Brother, & Co.

This book is the record of a vast amount of information, imparted to the pupils of the Philadelphia Central High School, in six lessons of 45 minutes each. Although published without any evident order or arrangement, it contains several excellent features, among which may be mentioned the construction of German sentences, the explanations of gender and *Umlaut*, and a quaint lecture on "The Philosophy of the English Language."

PRICE LISTS OF GOODS MANUFACTURED IN THE BIRMINGHAM DISTRICT, ENGLAND. Part I. London, England: Published by the Proprietors of "Iron," 12 Fetter Lane.

HIGH MASONRY DAMS. By John B. McMaster, C. E., Author of "Bridge and Tunnel Centers." Price 50 cents. New York city: D. Van Nostrand, 23 Broadway and 27 Warren street.

A practical and valuable little treatise, being No. 22 of Mr. Van Nostrand's Science Series.

SEVENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF MASSACHUSETTS, just published, is replete with useful information. Most of the legislative publications of the Old Bay State are so; but this cannot be said of many statistical reports issued by some other States, or of a great number which are authorized and published by approval of Congress. We are indebted to the State Board of Health, each year, for an early copy of their report, from which we are enabled to extract much useful information for our readers. The document before us leaves no branch of the subject of sanitary science untouched; and the statistics, especially those affecting population and mortality, are sufficient to convince any one of the national importance of the compulsory observance of health regulations. The report, moreover, furnishes to other State and city boards an excellent model for the preparation of such volumes, and a guide for the investigation of the subjects, which it would be well for them to follow.

DECISIONS OF THE COURT

Supreme Court of the United States.

PATENT ERASER PENCILS.—JOSEPH RECKENDORFER, APPEL ANT, *vs.* EBERHARD FABER.

Appeal from the Circuit Court of the United States for the Southern District of New York.

Mr. JUSTICE HUNT delivered the opinion of the Court.

This is an appeal from a decree of the United States Circuit Court for the Southern District of New York, dismissing the bill of complaint which was filed to restrain the infringement by the respondent of certain letters patent, and for an accounting and damages.

These patents relate to the manufacture of combined pencils and erasers.

1. The first was granted to Hymen L. Lipman, March 30, 1858, and was extended for a further term of seven years from the 30th of March, 1872.

The material parts of the specification are as follows:

"I make a lead pencil in the usual manner, reserving about one fourth of the length, in which I make a groove of suitable size, A, and insert in this groove a piece of prepared india rubber (or other erasive substance) secured to said pencil by being glued at one edge; the pencil is then finished in the usual manner, so that on cutting one end thereof you have the lead B, and on cutting one end you expose a small piece of india rubber, C, ready for use, and particularly valuable for removing or erasing lines, figures, etc., and not subject to be soiled, or mislaid on the table or desk.

"In making mathematical, architectural, and many other kinds of drawings, in which the lines are very near each other, the eraser is particularly useful, as it may be sharpened to a point to erase any marks between the lines; and should the point of the rubber become soiled or inoperative from any cause, such cause is easily removed by a renewed sharpening, as in the ordinary lead pencil."

The claim is as follows:

"I do not claim the use of a lead pencil with a piece of india rubber, or other erasing material, attached at one end for the purpose of erasing marks; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the lead and india rubber, or other erasing substance, in the holder of a drawing pencil, the whole being constructed and arranged substantially in the manner and for the purposes set forth."

The drawings forming part of the specification exhibit a continuous sheath of uniform size, with interior grooves of different sizes: the eraser groove being larger than the lead groove.

2. The second patent is for an improvement upon the invention of Lipman, and was granted to Joseph Reckendorfer, the complainant, the 4th of November, 1862, and reissued on the 1st of March, 1872.

The material parts of the specification are as follows:

"My invention is intended to provide a means whereby articles of greater size or diameter than the lead may be securely held in the head of a pencil of otherwise ordinary or suitable construction without making the body of the pencil cumbrous or inconvenient. To this end my invention consists:

"First.—Of a pencil composed of a wooden sheath and lead core, having one end of the sheath enlarged and recessed to constitute a receptacle for an eraser or other similar article, as hereinafter stated.

"Second.—Of a pencil, the wooden case of which gradually tapers from the enlarged and recessed head towards its opposite end for the whole or a portion of the length, as hereinafter set forth.

"The receptacle for the eraser or other article is formed in the head, without too much weakening the wood, owing to the form of the sheath, while for the same reason the end of the pencil which contains the ordinary lead is not cumbrous nor clumsy, but can be readily held between the fingers, just as an ordinary pencil is."

Having thus described his invention, Reckendorfer claims—

1. A pencil composed of a wooden sheath and lead core, having one end of the sheath enlarged and recessed to constitute a receptacle for an eraser, or other similar article, as shown and set forth.

"2. A pencil, the wooden case of which gradually tapers from its enlarged and recessed head toward its opposite end for the whole or a portion of its length, substantially as shown and described."

HOW THE PATENTABILITY OF AN INVENTION IS DETERMINED.

The points we propose here to discuss are two:

First. Is the article, patented by the plaintiff and his assignor, and for the infringement of which patents this action is brought, a patentable invention within the laws of the United States?

Second. Is it within the power of the courts to examine and determine this question, or is the decision of the Commissioner of Patents, when, by issuing a patent, he decides that the invention is patentable, final and conclusive on the point?

The plaintiff contends that the decision of the Commissioner is conclusive upon the point of invention, and that the question, as distinct from that of want of novelty, is one not open to the judgment of the court. In the natural order of things this question is the first one to be examined. For if it shall appear that the contention of the plaintiff is correct in this respect, the question in regard to the patentability of the instrument now before us will not arise. The point will have been decided for us, and by a controlling authority.

The "act to revise, consolidate, and amend the statutes relating to patents and copyrights," passed July 4, 1836, (5 U. S. Stats., 118,) is the act regulating this case.

By the 6th section thereof it is enacted "that any person having invented or devised any new and useful art, machine, manufacture, or composition of matter not known or used by others before his invention or discovery thereof, and not at the time of his application for a patent in public use, or on sale with his consent or allowance as the inventor or discoverer, and shall desire to obtain an exclusive property therein, may make application in writing to the commissioner expressing such desire, and the commissioner, on due proceedings had, may grant a patent therefor. * * He shall make oath that he believes himself to be the first inventor or discoverer thereof, and that he does not know or believe that the same has ever before been used."

Looking at this section alone it may be safely said no one is entitled to a patent unless (1) he has discovered or invented an art, machine, or manufacture, (2) which art, machine, or manufacture is new, (3) which is also useful, (4) which is not known or patented as therein mentioned. It is not sufficient that it is alleged, or supposed, or even adjudged by some officer to possess these requisites. It must in fact possess them, and that it does possess them the claimant must be prepared to establish in the mode in which all other claims are established, to wit, before the judicial tribunals of the country.

The 7th section of the act (p. 120) provides that on the filing of any such application, etc., and the payment of the duty required by law, the commissioner shall make, or cause to be made, an examination of the alleged new invention or discovery, and if on such examination it shall not appear to the commissioner that the same has been invented or discovered by any other person in this country prior to the alleged discovery, or patented or described in any foreign publication, or been in public use or on sale with the consent of the applicant, and if he shall be of the opinion that the same is sufficiently useful and important, the commissioner shall issue a patent therefor.

Before the commissioner is authorized to issue a patent it must appear to him that the claimant is justly entitled to a patent, that is, that his art, machine, or manufacture possesses all the qualities before mentioned. The commissioner must also be satisfied that if it possesses these qualities it is sufficiently useful and sufficiently important to justify him in investing it with the *prima facie* respect arising from the governmental approval. These restrictions are wise and prudent, are intended to secure at least a probable advantage to those who deal with the favorites of the government, for they may justly be so termed who receive the exclusive right of making or using, or vending particular arts or improvements.

THE JUDGMENT OF THE COMMISSIONER OF PATENTS NOT CONCLUSIVE.

It is nowhere declared in the statute that the decision of the commissioner as to the extent of the utility or importance of the improvement shall be conclusive upon that point, but in the section just quoted it is placed in the same category with the want of novelty and the other requisites of the statute, and it is expressly conceded by the appellant that the judgment of the commissioner on the question of novelty is not conclusive, but that that point is open to examination. On that subject the practice of the courts is uniform in holding it to be subject to enquiry.

The plaintiff's counsel, in his brief, put his argument in this form: "The commissioner, then, passes on these questions: 1. Did the applicant himself make the invention? This question is settled by his oath." This is true to the extent and for the purpose of issuing a patent, and to this extent only. When the patentee seeks to enforce his patent, he is liable to be defeated by proof that he did not make the invention. The judgment of the commissioner does not protect him against the effect of such evidence. "2. The counsel says: was the invention new? This question is solved by the examination required by the act." To the same extent only. The defence of want of novelty is set up every day in the courts, and is determined by the court or the jury as a question of fact upon the evidence adduced, and not upon the certificate of the commissioner. "3. The counsel says again: Is the invention sufficiently useful and important? This the commissioner settles for himself by the use of his own judgment. It is a question of official judgment." These questions are all questions of official judgment, and are all settled by the judgment of the commissioner. His judgment goes to the same extent upon each question. He determines and decides for the purpose of issuing or refusing a patent. When the patent is sought to be enforced, the questions, and each of them, are open to judicial examination. We see many reasons why all the questions of invention, novelty, and prior use should be open to examination in each case, and such we believe to be the course of the authorities and practice of the courts.

A reference to some of the most recent cases, and to those decided by this court will be sufficient. A review of all the cases in this court and the various circuit courts where this question has been alluded to will not be profitable.

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THE MERE SUBSTITUTION OF ONE WELL KNOWN MATERIAL FOR ANOTHER IS NOT PATENTABLE.

In Hotchkiss *vs.* Greenwood (11 How., 248), a patent had been granted for a "new and useful improvement in making door and other knobs, of all kinds of clay used in pottery and of porcelain," by having the cavity in which the screw or shank is inserted, by which they are fastened, largest at the bottom of its depth in form of a dovetail, and a screw formed therein by pouring in metal in a fused state. The precise question argued in this court and decided was of the patentability of this invention, and it was held not to be patentable. The only thing claimed as new was the substitution of a knob made of clay or porcelain for one made of wood. This, it was said, might be cheaper or better, but it was not the subject of a patent. The counsel for the defendants, in their points, there say: "The court now is called upon to decide whether this patent can be sustained for applying a well known material to a use to which it had not before been applied, without any new mode of using the material or any new mode of manufacturing the article sought to be covered by the patent." Mr. Justice Nelson delivered the opinion of the court to the effect already stated. Mr. Justice Woodbury dissented, not upon the question of the power of the court to pass upon the validity of the patent, but rather in regard to the manner in which the facts were submitted to the jury.

In Stimpson *vs.* Hardman (10 Wall., 117), it was decided that the engraving or stamping of the figure upon the surface of a roller for pebbling leather by pressure, where the use previously had been of a smooth roller, required no invention, that it was a change involving mechanical skill merely, and not patentable. Mr. Justice Clifford dissented from the majority of the court, but expressly says that the question of patentability is for the decision of the jury and not for the court, upon a bill of exceptions. The majority of the court held that the question could be considered upon a bill of exceptions, and no one claimed that the decision of the commissioner concluded the question.

In Hailes *vs.* Van Wormer (20 Wall., 353), the question of the patentability of certain improvements in stoves was largely discussed in this court upon appeal from the Circuit Court for the Northern District of New York. It was held that, if a new combination produces new and useful results, it is patentable, though all the constituents of the combination were known and in use previous to the combination. But the results must be the product of the combination, not a mere aggregate of several results, each the complete product of one of the combined elements. It was held that the facts there present did not create a compliance with this principle, and the judgment, that the plaintiff's bill be dismissed, was affirmed.

In Rubber Tip Pencil Co. *vs.* Howard (20 Wall., 498), the same principle was affirmed. In delivering the opinion, the Chief Justice says: "The question which naturally presents itself for consideration at the outset of this inquiry is whether the new article of manufacture, claimed as an invention, was patentable as such. If not, there is an end of the case, and we need not go farther." He makes a careful examination of the claim, and concludes that there is nothing patentable in the character of the invention.

In Smith *vs.* Nichols (21 Wallace, 115), an elaborate opinion to this same effect was delivered by Mr. Justice Swayne, and concurred in unanimously by the court. The only question discussed is the patentability of the invention.

Hicks *vs.* Kelsey, 18 Wall., 670, is a similar case. To this rule the case of Lyman *vs.* Osborne (11 Wall., 516), cited by the defendant, is no exception. The remarks there made are chiefly upon the subject of reissues, and are in accordance with the principles above set forth. Even as to reissues, their conclusiveness is limited to questions of fact, and is accompanied by the statement that they are re-examinable in court when it is apparent upon the face of the patent that the commissioner has exceeded his authority, or there is such a repugnance between the old and the new patent that it must be held as a matter of legal construction that the new patent is not for the same invention as that embraced and secured in the original patent.—(p. 543-4.)

We do not attach much significance to the fact that the 15th section of the act of 1836 allows the defendant to plead the general issue, and to give in evidence upon thirty days' notice special matter tending to prove the various matters therein referred to. The statute in that respect was intended to create an easy system of pleading, and to relieve from any doubt the admissibility in that form of the defences specified. The argument that, because permission is given to prove under the general issue that the specification does not contain the whole truth, or that it intentionally and deceitfully contains too much, or that the patentee was not the first discoverer, or that it had been in prior use, it follows that proof that there is no invention or discovery at all, or that the invention has no importance, cannot be made, is quite unsound. Proof that there is no invention or discovery strikes at the root of the whole claim. The patent is based on an affirmative fact, of which this is the direct negative. It needed no statute to aid or justify this defence. It is provable when it exists under any general denial, like the fact of not guilty or non-assumpsit in cases where guilt or a promise is first to be established.

Upon the proposition that the decision of the commissioner on the question of invention, its utility and importance, is conclusive, and that the same is not open to examination in the courts, we are unanimously of the opinion that the proposition is unsound. His decision in the allowance and issuance of a patent creates a *prima facie* right only; and upon all the questions involved therein, the validity of the patent is subject to an examination by the courts.

THE COMBINATION OF A PIECE OF RUBBER WITH A LEAD PENCIL NOT A PATENTABLE INVENTION.

2. We come, then, to the question: Does the article patented by Lipman and improved by Reckendorfer involve an invention, or is it a product of mechanical skill or a construction of convenience only?

The article presented is for the performance of mechanical operations, to produce mechanical results, and is a mechanical instrument as much as a brush, a pen, a stamp, a knife, a file, or a screw. Whether it is styled a manufacture, a tool, or a machine, it is an instrument intended to produce a useful mechanical result, and the question presents itself: Does it embody any new device, or any combination of devices producing a new result?

In the first place, what is not claimed by the specification of Lipman is to be observed. "I do not claim (he says) the use of a lead pencil with a piece of rubber attached to one end." Of course he does not claim a lead pencil as his invention, nor the use of a strip of india rubber for erasure. Each of these articles had been in long and general use. But he claims as his invention "the combination of the lead and india rubber in the holder of a drawing pencil," in the manner set forth. The claim is simply of the combination of the lead and india rubber in the holder of a drawing pencil; in other words, the use of an ordinary lead pencil, in one end of which, and for about one fourth of its length, is inserted a strip of india rubber, glued to one side of the pencil. The pencil is to be made in the "usual manner," that is, he takes an ordinary lead pencil, and in this he makes a groove of suitable size," giving no idea of what he deems a suitable size, and in this groove he inserts a piece of prepared india rubber, which is glued to one edge of the pencil. "The pencil is then finished in the usual manner, so that in cutting one end thereof you have the lead B, and on cutting the other end you expose a small piece of india rubber C, ready for use." It is evident that this manner of making or applying the instrument gives no aid to the patent. It must rest where the patentee claims to place it, that is, on the combination.

This combination consists only of the application of a piece of rubber to one end of the same piece of wood which makes a lead pencil. It is as if a patent should be granted for an article or a manufacture, as the patentee prefers to term it, consisting of a stick twelve inches long, on one end of which is an ordinary hammer, and on the other end is a screwdriver or a tack drawer, or, what you will see in use in every retail shop, a lead pencil, on one end of which is a steel pen. It is the case of a garden rake, on the handle end of which should be placed a hoe, or on the other side of the same end of which should be placed a hoe. In all these cases there might be the advantage of carrying about one instrument instead of two, or of avoiding the liability to loss or misplacing of separate tools. The instruments placed upon the same rod might be more convenient for use than when used separately. Each, however, continues to perform its own duty and nothing else. No effect is produced. No result follows from the joint use of the two.

A handle in common, a joint handle, does not create a new or combined operation. The handle for the pencil does not create or aid the handle for the eraser. The handle for the eraser does not create or aid the handle for the pencil. Each has and each requires a handle the same as it had and required, without reference to what is at the other end of the instrument, and the operation of the handle of and for each is precisely the same whether the new article is or is not at the other end of it. In this and the cases supposed, you have but a rake, a hoe, a hammer, a pencil, or an eraser, when you are done. The law requires more than a change of form, or juxtaposition of parts, or of the external arrangement of things, or of the order in which they are used, to give patentability.—Curtis on Patents, §50; Hailes *vs.* Van Wormer, 20 Wall. 353. A double use is not patentable, nor does its cheapness make it so.—Curtis, § 56, 73. An instrument or manufacture which is the result of mechanical skill merely is not patentable. Mechanical skill is one thing. Invention is a different thing. Perfection of workmanship, however much it may increase the convenience, extend the use, or diminish expense, is not patentable. The distinction between mechanical skill, with its conveniences and advantages, and inventive genius is recognized in all the cases.—Rubber Tip P. Co. *vs.* Howard, and other cases, sup.; Curtis, § 72, b.

WHAT CONSTITUTES A PATENTABLE COMBINATION.

The combination to be patentable must produce a different force or effect, or result in the combined forces or processes, from that given by their separate parts. There must be a new result produced by their union. If not so, it is only an aggregation of separate elements. An instance and illustration is found in the discovery that by the use of sulphur mixed with india rubber the rubber could be vulcanized, and that without this agent the rubber could not be vulcanized. The combination of the two produced a result or an article entirely different from that before in use. Another illustration may be found in the frame in a sawmill which advances the log regularly to meet the saw, and the saw which saws the log: the two coöperate and are simultaneous in their joint action of sawing through the whole log; or in the sewing machine, where one part advances the cloth and another part forms the stitches, the action being simultaneous in carrying on a continuous sewing. A stem-winding watch key is another instance. The office of the stem is to hold the watch or hang the chain to the watch. The office of the key is to wind it. When the stem is made the key, the joint duty of holding the chain and winding the watch is performed by the same instrument. A double effect is produced or a double duty performed by the combined result. In these and numerous like cases the parts coöperate in producing the final effect, sometimes simultaneously, sometimes successively. The result comes from the combined effect of the several parts, not simply from the separate action of each, and is, therefore, patentable.

In the case we are considering the parts claimed to make a combination are distinct and disconnected. There is no new result not only, but there is no joint operation. When the lead is used, it performs the same operation and in the same manner as it would do if there were no rubber at the other end of the pencil. When the rubber is used it is in the same manner and performs the same duty as if the lead were not in the same pencil. A pencil is laid down and a rubber is taken up, the one to write, the other to erase; a pencil is turned over to erase with, or an eraser is turned over to write with. The principle is the same in both instances. It may be more convenient to have the two instruments on one rod than on two. There may be a security against the absence of the tools of an artist or mechanic from the fact that, the greater the number, the greater the danger of loss. It may be more convenient to turn over the different ends of the same stick than to lay down one stick and take up another. This, however, is not invention within the patent law, as the authorities cited fully show. There is no relation between the instruments in the performance of their several functions, and no reciprocal action, no parts used in common.

We are of the opinion, that for the reasons given, neither the patent of Lipman nor the improvement of Reckendorfer can be sustained, and that the judgment of the circuit court dismissing the bill must be affirmed.

STRONG, J.—I dissent from so much of the opinion of the majority of the court as holds that the instrument or manufacture described in the patents exhibits no sufficient invention to warrant the grant of a patent for it.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

Wilfort H. Farris, Troy Station, Tenn.—When the cars are run together, the projecting end of a bar strikes against the end of the opposite drawhead, which causes bars to throw the link forward, so as to drop over the pin of the advancing drawhead. As the link drops into place, it strikes a pin and throws a pivoted block down, and the coupling is completed.

IMPROVED WATCH KEY.

John S. Birch, New York city.—The essential feature of this watch key is a contrivance by which adjustable cone-shaped jaws, for fitting parts of different sizes, are made to open by being thrust out of the end of a tubular case by a spirally grooved revolving tube. They are closed on the post to hold it for turning by a gentle endwise pressure on the case. Another feature of the invention is a friction contrivance to prevent the torsional action of the case on the cone-shaped jaws from working them loose on the post.

IMPROVED LEATHER-ROLLING MACHINE.

John Bright, Stoneham, Pa.—This is an improved machine for rolling sole leather, which includes several novel features in mechanical construction, mainly intended to render it simple, powerful, easily operated, and to enable it to pass over thick places in the leather without any jar to the foot lever.

IMPROVED CIGARETTE MACHINE.

Joseph Marengo and Alexandro Marengo, Montreal, Canada.—This invention consists in combining, with an adjustable roll, endless belt, and operative mechanism, a pair of rolls arranged on arms, one rigid and the other hinged, the former provided with a stop, and the latter with a regulating screw. By this means, the approximation of the rolls is definitely gaged, according to the size of cigar that is being made.

IMPROVED EXPANDING WELL CURB.

Alexander A. Peck, Hammond, Wis.—This consists of an expanding curb, to be used for cement-lining wells, constructed with a sectional shell of vertical planks and sheet metal plates for lapping the joints, and with adjustable arms and expanding rims. The latter are coupled to a center shaft by which the shell is expanded and contracted, and also shifted along as the work progresses.

IMPROVED ELEVATOR.

Jacob Meyer, Hollowayville, Ill.—To each arm of a braced crosspiece, at the top of a post, are attached pulleys, over which pass ropes which lead to shafts provided with ratchet wheels and cranks, and secured to the side of the post. To the other ends of the ropes are attached hooks, to receive the eyes of the bails, two of which are connected with the ends of each rope. For raising a hay rack, the four ends of the two bails are connected, and the rack is raised by turning the crank. For raising a wagon body, a rectangular frame is attached with the four ends of the two bails. To the frame are pivoted four rods, the lower ends of which connect with the ends of the crossbars of the wagon body. By operating the crank shaft, the wagon body may all be raised together, and without disarranging any of its parts.

IMPROVED CAR FOR ONE-RAIL RAILWAY.

David B. James, Visalia, Cal.—This invention consists of one line of broad-faced wheels in the center to carry the load, and small guide wheels to run each side of the rail on vertical axles projecting down from the car. These wheels serve to keep the carrying wheels on the track and to prevent the cars from overturning, and are made to grip the rail. The wheels are connected with a platform which just clears the rail, and the car is mounted on pivots arranged in the line of the wheels and supported on the platform, so that the load is balanced on the wheels, and the center of gravity is lowered. The guide wheels running against the sides of the rails move from and toward the rails, and are provided with springs to keep them in contact. The essential advantage claimed for this contrivance is the economy in the cost of the track that it affords, one rail only being required and that being of wood.

IMPROVED RATCHET STOP FOR WATCHES, ETC.

James D. McAnlis, Beaver Falls, Pa.—This is mainly designed as a substitute for the spring pawls for ratchet wheels in machinery in which strong springs have to be retained at one tooth of the wheel, so that the tooth click is liable to break and get worn. It consists of a ratchet wheel, in combination with one or more small pinions that slide in a recessed and toothed encircling frame, and allow the turning of the ratchets in one direction, while stopping them positively in the opposite direction.

IMPROVED RAILROAD JOINT.

Richard O. Keefe, Omaha, Neb.—This inventor proposes to use a short section of a rail between the rail ends when they separate by contraction, in order to tighten the joint. Duplicate bolt holes are made in the fishplate for shifting the fastening bolts, as may be required by the shifting of the holes in the rails.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WINDOW-SHUTTER OPENER.

John R. Day, New York city.—This is a contrivance for opening fireproof shutters from the outside of the building in case of fire and the like. It consists of a spring slide bolt and hasp for fastening the shutters, contrived so that the hasp will hook on the bolt to fasten. The bolt may be drawn back by hand to unfasten the shutters from the inside. Also it can be drawn back from the outside of the building by a hand lever, with which it connects by rods and levers. Any desired number of fasteners are all connected to one lever, so that they can be opened. The lever is arranged in a lock-up case.

IMPROVED ELASTIC BLOCK FOR SPLITTING KINDLING WOOD.

John C. Hubbs, New York city.—The object of this invention is to furnish a block for splitting kindling wood, so constructed that wood may be split upon it while standing upon the floor without injuring the floor or jarring the room, and which, when not in use as a splitting block, may be used as a seat. The invention consists in a splitting block formed of two blocks, with interposed springs, guide pins, and flexible strips, and in the combination of a cover with the splitting block to form a seat. The splitting is done upon the top of the block, and the jar of the blow is received by the springs, so that the floor will not be jarred or injured.

IMPROVED CULINARY VESSEL.

Daniel J. Esser, Mauch Chunk, Pa.—The inventor states that this vessel is adapted to cook in a perfectly odorless and inoffensive manner. It consists of a sectional vessel with central bottom opening, closed top, and bottom supports, adapted to place different sizes of cooking vessels and broilers within the same.

IMPROVED ROCKING CHAIR.

Martin Schrenkeisen, New York city.—The object of this invention is to improve the construction of the rocking chair for which letters patent were issued to Charles Brada, October 20, 1874, to counteract the tendency of said chair to lean forward. This is done by rear springs arranged to counterbalance the front springs, the two sets of springs being coiled in opposite directions.

IMPROVED BIRD CAGE.

John D. Heins, New York city.—This improved cage is intended for mating two or more female birds with one male, and consists of close partitions, dividing it into two or more compartments. These partitions are provided with a passage and a sliding door, to be opened at will for allowing the male bird to pass out of one compartment into another when one female has gone on her nest. The partitions are made to rise and be supported a little above the tray in the bottom, for drawing it out for cleaning.

IMPROVED COMBINED IRONING BOARD AND TABLE

James A. Geraghty, Newark, N. J.—This device is so constructed that, when the ironing board is required for use, it may be securely connected with and supported from the table, and, when not required for use, can be placed beneath the top of said table, so as to be entirely out of the way.

IMPROVED SASH HOLDER.

Henry Powelson, New Brunswick, N. J.—This is a combination of two rods and a cone-pointed screw with the sash and casing of a window. The screw is inserted between the inner ends of the bars, so that, by turning the said screw inward, it forces the latter outward, pressing their outer ends against the casing, and thus locking the sash in place.

IMPROVED HOT AIR FURNACE.

David Boyd, New York city.—By this invention, the heat is divided into two longitudinal compartments, one of which contains the pipes and flues that carry off the smoke and heated products of combustion, and the other compartment contains the fire pot and heating parts of the furnace, thus making two separate radiators. Each chamber is properly supplied with air to be heated, so that the whole capacity of both is utilized.

IMPROVED WASH BOILER.

Emmor M. Mallett, Westville, Mich.—In using the washer, when the steam begins to form, it forces the water up through the tubes to be discharged upon the clothes. The water passes down through the clothes, through the holes in the false bottom, through channels formed by plates to the bottom of the boiler, to be again forced up through the pipes, and be discharged upon the clothes.

IMPROVED WASHING MACHINE.

William Bymaster, Jamestown, Ind.—In using the machine, the clothes to be washed are placed upon a stationary rubber, and a sufficient quantity of soap and water are put in. The movable rubber is lowered upon the clothes, and the cover is secured in place. The operator then grasps a cross bar in his hands, and turns the rubber back and forth, which washes the clothes thoroughly.

IMPROVED BACK SUPPORT FOR BATH TUBS

Emil F. W. Eisenmann, New York city.—This consists of a back support, attached to lateral webbing suspended by straps from side rods of the tub, the support being adjustable along the supporting rods by stop pins.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED GUIDE FOR SAWING MACHINES.

Harrison P. Taylor, Franklin A. Perdue, and Jeremiah M. Perdue Minerva, Ohio.—This is a guide for sawing machines, planers, etc., which may be adjusted to vary the width, the bevel, or the taper of the work, without the use of a rule, square, line, or gage.

IMPROVED LADIES' WORK TABLE.

L. Frances Woodward, Woodstock, Vt.—This table has separate places for the various articles used for ladies' work, so that they may be at all times conveniently accessible. It is made of such a hight as to be convenient for the seamstress while sitting upon a low sewing chair, and light, so that it can be readily carried from place to place.

IMPROVED SCHOOL DESK.

David I. Stagg, New York city.—This is an improved folding desk which shall be so constructed that the desk board may be turned into a vertical position, or turned over to lie against the front of the desk.

IMPROVED VELOCIPEDE.

Earl A. Wheeler, Sharon, Pa.—This invention consists in driving the large wheels of a three-wheeled velocipede by means of treadle mechanism that turns the axle, while end ratchets of the latter carry pawls on the wheels, and rotate the same in a forward direction.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BAG HOLDER.

John T. Brown, Morrisville, Va., and Joseph Colbert, Fredericksburg, Va.—This invention consists of a hopper provided with hooks for the attachment of the bag and sliding upon the front surfaces of two ratchet-toothed uprights, against which it is held by two clips provided with flanges that rest against the rear surfaces of the uprights. To the upper clip are pivoted two detents which are pressed between the teeth of the uprights by springs attached to the lower clip. The upper portions of the detents form handles, by means of which their points are released from the teeth and the hopper raised or lowered. The uprights are fixed to a base piece, upon which the bag rests while being filled.

IMPROVED TERRET PAD.

John R. Basiger, Harrisonville, Mo.—This is made of a screw socket for a terret ring, with a recess for retaining the layer of the back band. There is also a base plate, with extension lugs, for being riveted or screwed to the back band. The device is adapted for animals used for heavy work.

IMPROVED MUSICAL TOP.

Ella N. Gaillard, New York city.—In this pretty and ingenious toy is placed a musical box, to the running gear of which stop mechanism is connected, which is released when the top begins to spin, allowing the musical box to play. When the power imparted by the act of spinning the top is exhausted, and the top stops, the stop mechanism resumes its duty, and the music ceases. The inventor states that bells or chimes may be used in place of the tongued plate of steel commonly used in musical boxes.

IMPROVED TOBACCO-CURING APPARATUS.

John B. Smith, Milton, N. C.—The tobacco leaves are strung on wires which are passed through the stems as the leaves are gathered. When full the wires are attached to frames. These, when loaded, are placed with their ends between guide studs of the curing house, and hoisted up to the position where they are to rest for drying by suitable tackle, and are secured by cross pieces. When sufficiently dried, the frames are let down and the leaves stripped off from the wires.

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Notes & Queries

M. J. G. can give a gloss to writing ink by dissolving a little refined sugar in it.—J. W. is confusing brass and bronze. The former is made with zinc, the latter with tin. The article on manganese bronze, p. 353, vol. 34, is perfectly correct.—C. W. T. will find particulars of a fast railway train in this country on p. 393, vol. 34. Mr. Brunel's 78 miles an hour was done on the Great Western Railway, England.—W. W. B. will find on pp. 320, 336, 352, vol. 34, a history of the progress of the past century.—A. V. W. can remove ink from writing paper by the process described on p. 154, vol. 34.—A. P. can calculate the proportions of screw-cutting gears by the method described on p. 107, vol. 34.—T. W. M. will find a description of the Gulf weed on p. 91, vol. 31.—G. T. W. will find an answer to his cannon and car question on p. 273, vol. 32. As to the relative speeds of the top and bottom of a wagon wheel, see p. 298, vol. 31.—K. L. C. will find a description of the operation of a fly wheel on p. 288, vol. 28.—J. F. S. will find on p. 329, vol. 33, a description of a battery suited to an electric light.—G. will find on p. 213, vol. 34, directions for making polishing starch for laundry use.—F. J. R. will find on p. 344, vol. 34, particulars of the fastest trains on record.—A. S. can prepare fulminate of mercury by the formula given on p. 234, vol. 30.—S. G. A. can measure high temperatures with a pyrometer. See p. 50, vol. 33.—E. E. N. will find directions for polishing metals on p. 57, vol. 34. For the best method of polishing plated work, see p. 251, vol. 33.—R. W. D. and others will find an explanation of the different speeds of points on a carriage wheel on p. 298, vol. 31.—F. W. B. and A. L. will find directions for making colored fires on p. 203, vol. 34.—G. D. can purify water for drinking purposes by the process described on p. 395, vol. 32.—O. can lacquer his fine brass work. See p. 242, vol. 34.—W. J. McL. will find on p. 376, vol. 24, a description of the use of the steam plow in this country.—J. H. M. will find on p. 74, vol. 32, a recipe for balloon varnish.—E. B. R. will find on p. 214, vol. 32. a description of a boiler injector.—C. M. N. can bleach straw hats with sulphurous acid. See p. 11, vol. 32.—D. J. T. will find on p. 348, vol. 34, a description of the deepest well.—A. A. S. will find on p. 331, vol. 32, directions for measuring the piece of timber.—E. A. M. will find on p. 180, vol. 26, directions for proportioning cone pulleys.—E. O. R. can find on p. 186, vol. 34, a recipe for a depilatory.—E. D. R. will find on p. 186, vol. 34, directions for nickel-plating his brass instruments.—B. F. J. should consult a physician.—W. F. B. does not state what his boiler covering is made of.—P. F. E.'s question is merely metaphysical.—M. B. can bronze brass castings by the method described on p. 51, vol. 33.—D. H., C. W. S., J. B. H., C. F., B. L., W. B., R. J., R. N., E. N., S. V. N., M. D., W. K., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. H. Jr., asks: 1. To what extent will a column of mercury expand when contained in a ½ inch pipe, 2 feet long, a gentle heat being applied? A. Mercury expands about 0·018 of its volume when heated from 32° to 212°. 2. Will mercury, when confined, expand with great force, like iron or other metal when slightly heated? A. Yes. 3. Will mercury injure iron in any way? A. Under ordinary conditions, no.

1. When gunpowder is exploded, is it changed into gas? A. Yes. 2. Could a little be exploded in a strong iron vessel until a great pressure is obtained, and the gas then be used to drive an engine? A. Such plans have been proposed. Usually, however, the gunpowder is inimical to confinement.

(2) F. C. S. says: 1. I am running a small engine of six horse power, but the boiler is rated at 12 or 15 horse. How many bushels screenings ought it to take to run the engine one day? A. The question is too indefinite. 2. What kind of grate ought we to use for screenings? A. One with narrow air spaces. 3. Which is the most economical, to keep a thick or thin layer of screenings for the fire? A. That depends somewhat upon the draft; and any one can readily settle the matter for his particular case by a few trials.

(3) E. P. says: I have occasion to use permanganate of potassa solution in staining woodwork, and have had some trouble on account of its affinity for metals. Of what metal shall I make a tank 2 feet by 4 feet, and 8 inches deep, to contain permanganate of potassa solution? A. In contact with strong solutions of this salt, all of the more common metals are gradually oxidized and dissolved. Vessels of glass, porcelain, or porcelain-lined iron may be employed; or, in case these cannot be obtained of sufficient capacity, tanks or wells made of brick, and lined with large flags and good cement, could be made to serve your purpose.

(4) J. C. O. asks: What effect will kerosene oil have on galvanized iron? A. If the oil contains no free mineral acids, it will not injure the iron. Galvanize your iron on both sides.

(5) E. H. M. says: 1. I am running 5 pairs of stones, using hard coal screenings. Will the arrangement work equally for burning soft coal slack, tan bark, etc.? A. It does not necessarily follow that a furnace giving good results with refuse coal will also answer for wet tan and sawdust. 2. I get an intense heat, but am afraid my boiler will not stand it, as I have only 20 feet of fire grate surface. Would it be better to double the grate surface, and keep a thinner fire? A. If you will send us a sketch of your furnace, we will be glad to give our opinion. From your account you seem to be doing very well.

(6) S. H. asks: Is there any way of sawing cast steel bars as large as 6x1½ inches, when hot? A. Bars of steel or iron of any size can be cut off, either hot or cold, with a circular frictional disk running at great velocity. The rim of such a saw should travel at about 20,000 feet per minute.—J. E. E., of Pa.

(7) W. K. P. asks: Will you please be kind enough to give me a good recipe for making red calcium lights, such as are used on stages, tableaux, etc.? A. Place the light in a suitable lantern provided with a large condensing lens. The color of the rays may then be varied to suit the fancy by interposing near their focal point pieces of thin, finely colored glass. The glass employed for this purpose should be small, well annealed, of uniform texture, and as thin as possible.

(8) G. T. W. asks: If there be a hill three miles over and one across the base, would it take any more stakes or palings to build a fence over the hill, three miles, than to build one across the base, one mile, if the stakes or palings stand perpendicularly? A. No.

(9) W. B. says: 1. Animal and vegetable oils will bleach in the spring when we have cool days (in the ordinary glass bleaching houses, such as are familiar to all oil manufacturers, and which resemble an ordinary hot house) much faster than they will at midsummer, when the sun is stronger and the atmosphere hot. Why is this so? An ordinary observer would suppose that, the hotter the sun was, the faster the oil would bleach; but this is not the case. A. The bleaching quality of sunlight is chiefly confined to the more refrangible rays of the upper or violet end of the spectrum. They seem to act by virtue of a peculiar reducing or deoxidizing power; while the heat rays, or those from the lower or red end of the spectrum, on the contrary, serve to stimulate oxidation and fermentation. This latter force is comparatively slow in its action in comparison with the activity of the former, and can therefore only slightly influence or retard the final results. 2. Can you tell me the reason why hothouses and forcing houses for plants are always ventilated at the top? A. You are mistaken as to the fact.

(10) R. H. says: In making French mustard, I have some trouble in bottling the same. After being bottled, it ferments and forces the corks out, and smells badly. What can I do to prevent this? A. After filling the bottles, place them loosely stoppered in a large vessel of water, which gradually raise to the boiling point. Then remove the bottles and seal them. It is common to allow the bottles to stand 48 hours before performing the above operation.

(11) F. McA. asks: With what can I clean diamonds? A. You fail to state with what the stones are soiled. Try the following list of substances in the order named: Water, alcohol, ether, hot benzole or naphtha, bisulphide of carbon, dilute acids, dilute alkalies, strong acids, strong alkalies, mechanical friction with putty powder, rouge, fine emery.

(12) F. J. says: I wish to have cast a vessel somewhat like the air chamber of a hydraulic ram, but wider at the bottom, being 7½ inches in diameter at base, 10½ inches in widest part, and 12 inches high. What is the least thickness it should have to safely sustain a pressure of 75 to 80 lbs. to the square inch, if made of ordinary cast iron, and of cast malleable iron? A. It should not be less than ¼ or ⅜ of an inch thick, in either case.

(13) J. C. Jr. asks: 1. How can I make a cheap soda water fountain for family use? A. It would be safer for you to purchase one. 2. What is the composition of soda water? A. The so-called soda water is simply water that has been supercharged with carbonic acid gas under pressure. When allowed to escape from under pressure, a portion of the dissolved gas escapes into the air, causing the effervescence or briskness of the beverage.

(14) H. S. K. says: In making small anchovy casks, the staves are cut with a bilge, and leak. The brine oozes out through the pores of the oak because they are cut with the bilge. Is there any preparation that will make them tight? A. It is common to fill the pores of the wood with hot rosin. If this does not give satisfaction, try the following: Make a strong solution of glue in hot water and add a sufficient quantity of tannin to precipitate all the glue. Wash this precipitate of tannate of gelatin (artificial leather) in running water for some time, dissolve it in boiling vinegar, and while hot flow the interior of the cask with the liquid. Allow it to partially dry, and then fill the cask with clean water, allow to stand for several hours, and finally remove the water, invert the cask, and allow to dry.

(15) J. M. M. asks: 1. How can I bleach stearin at one operation? I am at present obliged to melt the stearin twice (for making candles); the first melting leaves it too yellow. A. Your method is perhaps one of the most practical and economical. 2. What is the cause of the yellowish tint? A. The color is due to a mechanical admixture of liquid oleic acid with the crystals of the solid stearic and margaric acids.

(16) J. M. H. asks: Has there ever been invented any means to destroy the dead center in an engine? A. Yes. Rotary engines have no dead centers.

(17) A. I. P. asks: 1. How can the two rules, published on p. 33, vol. 33, and p. 276, vol. 34, relating to the power of small engines, be reconciled? A. The first rule is for the actual horse power, and includes deductions for friction of pipes, friction of mechanism, condensation, radiation, etc. To apply the second rule, the average steam pressure, which would not be equal to the initial pressure, must be known.

(18) R. B. says: I am about to organize a fire brigade, each man to be armed with, among other things, a knotted cord 20 feet long with a hook on the end, so that he can go upon the roof of a building and sustain himself by the hook and cord from the ridge pole. Can a rope be so prepared as to be non-combustible, that is, when in use as described? A. Probably the best thing you could use would be rope of galvanized iron wire, which is very strong and quite flexible. Knots can easily be made at intervals by weaving in a single strand of wire with the strands of the rope, so as to form the rings called by sailors Turk's heads. We cannot positively recommend any of the various fireproofing solutions when life depends on their efficacy. Tungstate of soda in solution is employed for fireproofing fabrics, but might not prevent charring, which would greatly weaken the rope. You might carry a core or strand of iron wire through the line, and use tungstate of soda in addition, the wire being strong enough to bear a man's weight in case the rope should be burnt through.

(19) E. O. says: Can you tell me how to treat wood so as to make a good plate for an electrical machine? A. There is no good way. Use glass or ebonite.

(20) H. M. W. says: 1. In your article on the apparent size of the moon, p. 305, vol. 34, you say that a ¼ inch hole at 28 inches distance would bring it under an angle of half a degree. What are we to understand 1° to be at that distance? A. Nearly ½ an inch, more correctly 0·47 inches. 2. In figuring I find 1° of a circle 11·46 inches in diameter to be $\frac{1}{10}$ of an inch, which would make ¼ inch at that distance occupy 2·5°. Am I correct? A. You are correct, and so were we. If a quarter inch hole at the distance of 6 inches is seen under an angle of 2·5°, it would at a distance of 28 inches be seen under an angle of 6x2·5° divided by 28, or 0·233 inch, for which we use 0·25 or ¼ inch, intending that the hole should slightly surpass the apparent size of the moon so as to allow the observer to see the edges.

(21) A. B. asks: Does the temperature of zinc and mercury rise when a current of electricity passes through them? A. No.

(22) F. I. M. says: 1. I have made a telegraph sounder and wound it with No. 20 (English gage) wire, 20 feet on each spool. It works well enough by itself; but when I put it on a line with other instruments, it fails. I think the wire is too large. What number (American gage) of wire should I have, and how many feet on each spool? A. Nos. 20 to 23 are good sizes; but there should be about 150 or 200 feet. 2. Where can I get full instructions for making an induction coil? A. See p. 344, vol. 33, and p. 362, vol. 31.

(23) C. S. M. asks: What is a birdseye view? A. It is a view taken from above the object, and is always a perspective, except when taken looking directly down.

(24) W. says: I have a building to protect from lightning. The size of tin roof and cornice is about 80 x 114 feet, and the house is about 35 feet from a canal, about 60 feet wide and many miles long. Will a rod of ordinary construction, with the lower end of it in the water of the canal or in the wet mud at the bottom of it, have a sufficient contact to give full protection? If not, what do you recommend? A. It should be understood that all conductors offer some resistance to the passage of electricity, and that a current divides among several conductors in proportion to their conducting powers. The materials of a building are to some extent conductors, consequently, unless the resistance of the rod and its connections with the earth are almost infinitely less than that of the building, some of the charge will pass by way of the latter. As a general thing the ordinary rod offers sufficiently long resistance or is a good conductor; but the earth connections in nine cases out of ten are faulty. Water is a better conductor than damp earth, to be sure; but the fact that an equal volume of water or of earth offers very many times greater resistance than metals seems to be overlooked. In order to reduce the resistance at the junction of the rod with the earth, the latter must have great surface contact with the former, and this is only effected by using exceedingly large metallic terminals for the rods. The statement of requirements referred to is not, in the main, extravagant.

(25) M. S. S. asks: 1. Have the poles of the earth the same temperature? A. It is supposed so. 2. Have they the same length of night and day? A. Yes, when the sun is on the equator. 3. How near to the poles does the land extend? A. That has not yet been determined.

(26) G. R. T. asks: Why does the moon go farther north and south than the sun? A. Because the moon's orbit is inclined 5° 9′ to the ecliptic, which causes her to go north of the equator 28° 36′, and also the same distance south, while the sun goes only 23° 27′.

(27) D. H. asks: 1. What pressure ought a boiler 18 inches long and of 6 inches diameter, made of $\frac{1}{16}$ inch copper, to stand per square inch, if bound with hoops of same metal, ¾ inch wide and 3 inches apart? A. It would be safe to carry from 75 to 80 lbs. 2. What size ought the cylinder to be in proportion to this boiler? A. Diameter ¾ x 1½ inches stroke. 3. What should be the diameter of the fly wheel? A. Make it 4 or 5 inches.

What is the easiest method of cleaning old files? A. Use a wire scratch brush.

(28) D. F. asks: How much steam will it take to lift 2,000 lbs. off a 5⅝ inch pipe, inside diameter? A. Divide 2,000 by the area of the pipe which gives nearly 25 square inches.

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(29) R. F. says: Is it not a generally accepted theory that, in order to double any given speed of a vessel propelled by steam, it requires four times the power? If so, why is it that a piece of timber shaped to the model of the hull of a steamer and drawn through the water by means of a string passing over pulleys, and with weight attached sufficient to pull the hull readily, has its motion accelerated to just double the speed when twice the weight is applied to the cord? A. You confound force and power. Suppose, in your experiment, the strain of the cord is 1 lb. and the speed 1 mile per hour, in the first case, and that, on increasing the strain of the cord to 2 lbs., the speed is 2 miles per hour. Then the power exerted in the second case, where twice the strain moves with twice the velocity, is 2×2=4 times the power exerted in the first case. This would be the deduction from the experiment as you have stated it; but your result is so much at variance with those obtained by other experimentors that we hesitate to accept it.

(30) B. N. G. asks: How much pressure of steam to the square inch will a tin can, that holds 1 quart and is made of medium quality tin, carry with safety? A. Do not exceed a pressure of 10 lbs.

(31) F. B. R. says: In an argument as to economy of exhaust jackets around steam engine cylinders, A contends that the exhaust keeps the cylinder warm, while B argues that the exhaust continually sweeps away the heat from the cylinder down to the temperature of exhaust in non-condensing engines, say to 212° at least. We noticed in your description of "Maxim's engine," May 6, 1876, that you uphold A.'s view of the case. Please tell us if that is the true theory. A. An engine jacketed with exhaust steam would have some advantage over another in which the cylinder was exposed to the air; at the same time, as long as the temperature of the interior of the cylinder is greater than that of the exhaust steam, the action described by B. must take place to some extent.

(32) H. A. S. asks: 1. Of what size should cedar logs be for an aqueduct, if bored with a 2 inch hole, to sustain a pressure of 100 feet of water? A. From 4 to 5 inches in diameter. 2. How thick should wrought iron pipe be for the same purpose? A. About $\frac{7}{32}$ of an inch.

(33) E. E. C. asks: What pressure of gas would be required to throw the oil from a well 1,050 feet deep, 4 inches in diameter? A. A pressure per square inch equal to the weight of a column of oil with 1 inch cross section and 1,050 feet high, with a slight addition to overcome friction.

(34) J. J. R. says: I have an ordinary furnace in the basement of a three story house. The furnace has a sheet iron cover which becomes hot and radiates in the cellar. Could I check the radiation by blanketing the cover with asbestos or other felting? A. Yes.

(35) J. E. T. asks: What is the horse power of a stream of water 10 feet deep and 10 feet wide, acting on an improved turbine under the most favorable circumstances? A. About 75 per cent of the full effect of the water.

(36) T. W. says: We steam our handles, which are made of ashwood, but find that a great many split and break in bending; is there any preparation we can put into the water to make the wood soften so it will not break? A. We think not. Good bending apparatus, thorough steaming, together with at least a fair quality of wood, will generally insure success.

(37) H. M. asks: 1. Can you tell me of an alloy, not containing copper, that would answer for the working parts of models? A. Type metal, composed of lead and antimony, will answer for many purposes. 2. What is the melting point of copper? A. About 2,500° Fah.

At what speed must I run an emery wheel 3 inches in diameter? A. At from 3,000 to 3,500 revolutions per minute.

(38) M. M. H. asks: Will as much water fall into a vessel at an angle of 45° or 60°, driven by the wind, as when falling perpendicularly? A. No.

(39) F. C. R. asks: 1. Will a horizontal boiler 2½ feet long by 14 inches diameter be large enough to furnish steam for an oscillating engine 2¼ inches diameter by 4 inches stroke, making 100 revolutions per minute? A. It is rather too small. 2. Would such a boiler, of black sheet iron, carry 40 or 50 lbs. of steam with safety? Thickness of iron is $\frac{3}{16}$ of an inch. A. It will carry about 40 lbs., if well built.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. H. D. P.—The gas is probably carburetted hydrogen. The water contains a large percentage of chloride of sodium. This might be recovered by evaporation.—W. J. C.—Your specimens have been mislaid. Minerals should be sent in a separate package, labeled with the name and address of the sender.—W. W. K.—It is magnesium limestone.—E. E. H.—It is a variety of white pipe clay.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Crime and its Cause. By T.D.
On the Potato Bug. By E. S G.
On a Check Mark. By H. S.
On Logwood. By L. S.
On the Baroscope. By D. M.
On Propelling Ships. By D. H. McC.
On the Glacial Period. By C. C. F.
On a Mirror. By M. McG.
On Flax Growing in the West. By S. E. W.

Also inquiries and answers from the following:

W. M. A.—D. M.—I. S.—W. J. B.—J. C. D.—J. L. B.—R. B.—B. A. A. B.—H. McM.—W. B. W.—P. H. W.—N. P.—F. W.—W. A. R.—P. E. A.—C. E.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes an ash felt covering for steam boilers? Who makes steam traps? Whose is the best theodolite? Why do not makers of malleable glass advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending,

May 30, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn &Co., 37 Park Row, New York city.

Acid powder, J. V. Hecker 178,146
Air or stench trap, C. W. Garland 178,137
Alarm, burglar, J. H. P. Inslee 178,009
Amalgamator, L. Hinckley 178,005
Animal weaning bit, McGee *et al* 178,176
Annunciator, electric, Axtheim & Pease 177,918
Annunciator, electric, A. S. Wetmore 178,216
Auger, earth, C. W. Twigg 178,207
Auricle, J. H. Batchelder 177,984
Bale tie, J. L. Randolph 177,957
Bale tie, J. H. Snyder 178,196
Bale tie wire, bending, H. W. Putnam 178,027
Barrels, protector in tapping, B. Brown 178,104
Baskets, making, L. Porter 178,026
Battery, galvanic, R. Einbigler 177,896
Battery, galvanic, J. E. Watson 178,215
Bed bottom, spring, W. I. Winne 178,088
Bed dusting rack, J. Foster 178,135
Bed frame, adjustment, W. J. Myers 177,952
Bed lounge, W. E. Buser 178,111
Bed lounge, J. Hocy (r) 7,140
Bedstead, sofa, J. Reich 177,958
Bedstead, wardrobe, J. H. Horsfall 177,941
Bedstead, wardrobe, J. W. Post 177,956
Bell, door, J. M. Hinchey 178,056
Billiard tables, lighting, H. C. Hayt 177,998
Bird cage, G. F. J. Colburn 177,924
Bird cage, G. Günther 178,142
Bird cage, O. W. Taft 178,208
Bolt, Robinson & Ferris 178,080
Bolt for trunks, tray, G. Crouch 178,117
Bone black, revivifying, J. Gandolfo 7,146
Book case, revolving, J. J. Crandall 177,993
Book-stabbing machine, Hickok & Cooper 178,147
Boot and shoe heel, J. W. Jones 178,158
Boot spring shank, S. P. Littlefield 177,945
Bottle stopper, M. J. Hinden 178,006
Bottle stopper, P. Miles 178,019
Box for bottles, J. Matthews 178,175
Bridal bit, E. Lilienthal 178,013
Broom, Kellogg & Bunker 178,011
Bucket and cooker, dinner, F. Zugg 177,978
Buckle, A. B. Shaw (r) 7,141
Buckle, L. A. Sprague 178,197
Buildings, metal cover for, Belt & Perkins 177,986
Burners, shade for gas, W. F. Bonnell, Jr. 177,921
Bu ter worker, C. Plyers 178,078
Can, meat, J. A. Wilson 178,219
Can, oil, W. H. & W. J. Clark 178,115
Canister, W. T. Sherer (r) 7,150
Car axle lubricator, J. M. McDonald 178,017
Car brake, J. Blanshan 178,045
Car coupling, N. Darrow 178,049
Car coupling, H. Howson 178,149
Car coupling, J. W. Jones 178,010
Car coupling, W. E. Leonard 178,169
Car coupling, J. F. Roehm 178,081
Car coupling, H. O. Werner 178,056
Car coupling tightener, W. B. Dunning 177,994, 177,995
Car dumping, D. Manuel 178,070
Car heating apparatus, F. A. Miller 178,178
Car starter, Moschcowitz & Jasper 178,021
Car trucks, shifting, R. H. Ramsey 178,079
Car wheel railway, R. N. Allen (r) 7,142
Carpet stretcher, J. S. Ingham 178,060
Carpet stretcher, M. W. Knox 178,064
Carriage step, C. H. Gould (r) 7,147
Cartridge, A. Hall 178,055
Chair, reclining, J. W. McDonough 178,016
Chair seats, shaping, A. P. Johnson 178,157
Chimney cowl, P. J. Dambach 178,119
Churn, Frank & Kissling 178,136
Cisterns, water-filtering, S. E. Mosher 178,020
Clamp, joiner's, G. A. Naumann 178,022
Clay wheels, operating, W. A. & T. Ellis 178,126
Clothes pounder, E. R. Swan 178,202
Clothes sprinkler, Ballou & Woerd 178,036
Coffee polish, C. H. Nichols 177,954
Coffee pot, C. Vanderbeck 178,091
Comb, back, J. W. Fleischmann (r) 7,145
Compass, mariner's, S. Bent 178,098
Connecting rod, extension, A. G. Lull 178,014
Cotton cleaner, seed, W. L. Crowson 178,118
Cultivator, tooth, J. Mitchell 178,180
Cuspadore, J. Pfund 178,025
Dead centers, overcoming, T. L. Hubbard 178,150
Dental heater, L. W. Clark 178,114
Digger, potato, A. Rigby 178,191
Door hanger, W. G. Collins 178,116
Drill, double bitted, W. H. Yarborough 178,220
Drilling machine, rock, J. B. Waring 178,214
Duster, feather, S. M. Hibbard 177,939
Ear ring, W. P. Yeoman 178,040
Ejector, steam, W. Ebbitt 177,927
Elevator, M. E. & O. T. Dozier 178,124
Engine, hydraulic, W. Smith 177,967
Engine, pumping, F. W. Köttgen 178,163
Engine, steam, C. Duecker 178,125
Engine valve gear, Sulzer & Ernst 178,201
Evaporating pan, S. S. Connor 178,047
Explosive compound, C. G. Bjorkman 177,988
Faucet, P. Skelly 178,083
Fence, barbed iron, E. Sims 178,195
Fertilizer, A. W. Rowland 178,194
Fifth wheel for vehicles, P. La Belle 177,942
Fire extinguisher, J. Block 178,101
Fire kindler, B. Bicknell 178,099
Flagstaff holder, A. Kocisch 178,012
Floor, tesselated, S. P. Groocock 178,141
Flue cleaner, Hobbs & Johnston 178,007
Furnace grate, W. J. Smith 178,080
Furnaces, spark arrester, etc., for, H. Pindar 178,189
Gas distributor, J. R. Shirley 177,965
Gas engine, A. De Bisschop 178,121
Gas fixture, J. McHenry 178,177
Gas lighter, automatic, K. Vogel 178,211
Gas motor engine, N. A. Otto 178,023
Gas regulator, G. W. Hambright 178,134
Gas stoves, oven for, J. R. Shirley 177,966
Generator, lamp steam, H. Fritz 177,930
Girder, metallic, J. L. Nostrand 178,076
Governor, speed, J. M. King 178,068
Grain binder, H. H. Bridenthall, Jr 177,990
Grain hulling machine, J. A. A. Buchholz 178,108
Grain weigher, J. T. Carmony 178,046
Grape vine support, Z. F. Mahorney 178, 173
Grate, W. H. Lotz 178,171
Guns, dart for air. A. W. Gifford 177,932
Hair crimper, W. F. Drew 177,926
Hammer, drop, F. H. Richards 177,960
Harness, J. L. White 178,217
Harness clamp, J. McCormick 178,072
Harvester, J. H. Elward (r) 7,144
Harvester, J. H. Elward 178,127
Harvester, A. T. Nord 178,185
Harvester rake, D. H. Kime 178,160
Heater, steam, A. Van Horn (r) 7,152
Hedge, plashed, D. M. Kirkbride 178,161
Hemp and flax brake, L. E. Burdin 178,110
Hook fastening, suspension, W. H. Haines 177,936
Horse boot, H. B. Cook 177,991
Horseshoe nails trimming. A. H. Caryl 178,113
Hose goods, H. G. Hubbard 178,058
Hydrant, J. T. Davis 178,120
Hydrant, J. Farnan 178,129
Ice cream freezer, J. W. Olmsted 178,186
Ice machine, J. F. Gesner 177,999
Indicator, station, C. A. Evans 178,128
Insect powder gun, C. B. Dickinson 178,050
Iron ware, enameled, F.G. Niedringhaus *et al* 177,953
Japan or varnish, base for, W. P. Jenney 178,153
Key hole guard, La Blanc & St. Pierre 178,065
Knife rack and rest, A. R. Byrkit 178,112
Knife scouring machine, H. Symonds 178,088
Knives, handle for pocket, J. W. Gardner 177,998
Knitting machine, rotary, T. Langham 178,167
Laddles, stopper for pouring, W. H. Haws 178,003
Lamp chimney, E. Tolman, Jr 178,089
Lamp extinguisher, G. W. Martin 177,947
Lamp steam generator and boiler, H. Fritz 177,930
Latch, door, O. H. Gilbert 177,933
Leather-creasing machine, J. B. Stetson 178,199
Loom, E. B. Bigelow 177,920
Mail bags, attaching tags to, G. H. Fayman 178,130
Mangle, F. Krickhahn 178,164
Marker, land, J. Augspurger 177,915, 177,916
Meat cutter, J. Hughes 178,151
Mechanical movement, Jordan *et al* 178,062
Mechanical movement, M. G. Mosher 178,074
Mechanical movement, H. Olsen 178,187
Mechanical movement, K. Vogel 178,212
Mill, bark, O. Coogan (r) 7,143
Mill feeder, J. D. Mines 178,179
Mordant, F. J. Bird 177,987
Mower, R. D. Thomson 178,084
Mower, lawn, J. C. & C. J. Sturgeon 178,032
Mowing machine, C. B. Martin 178,071
Music leaf turners, C. P. Brown 178,106, 178,107
Nail extractor, M. H. Frank 178,053
Nail screw, J. Göbbels 178,000
Nut lock, M. A. Spafford 178,086
Nut lock. I. VanKuran 178,090
Oil, resinous substance from, W. P. Jenney 178,061
Organ stock, planing metal, S. C. Symonds 178,033
Organ stop action, rced, J. Florey 177,997
Organ stop action, H. Smith 178,085
Organ treadle, adjustable, J. S. Robinson 177,962
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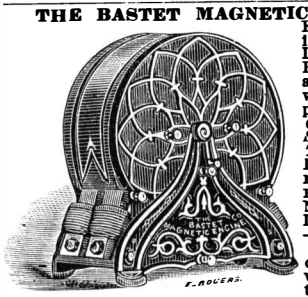

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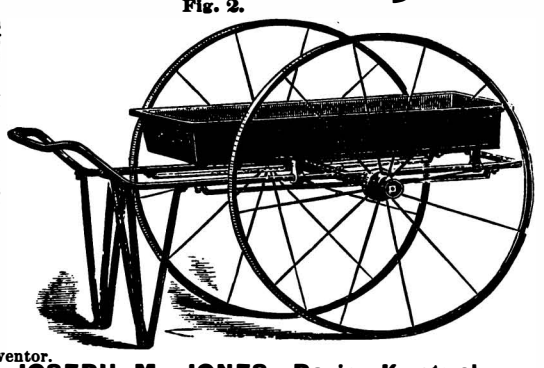

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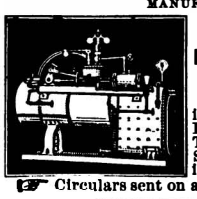

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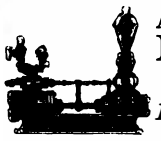

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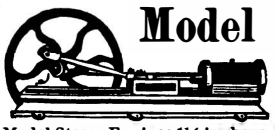

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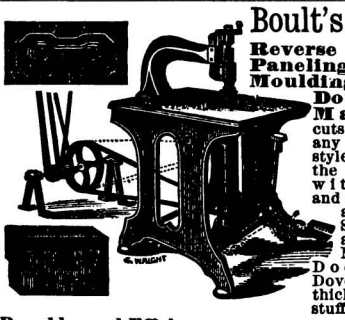

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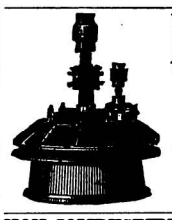

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